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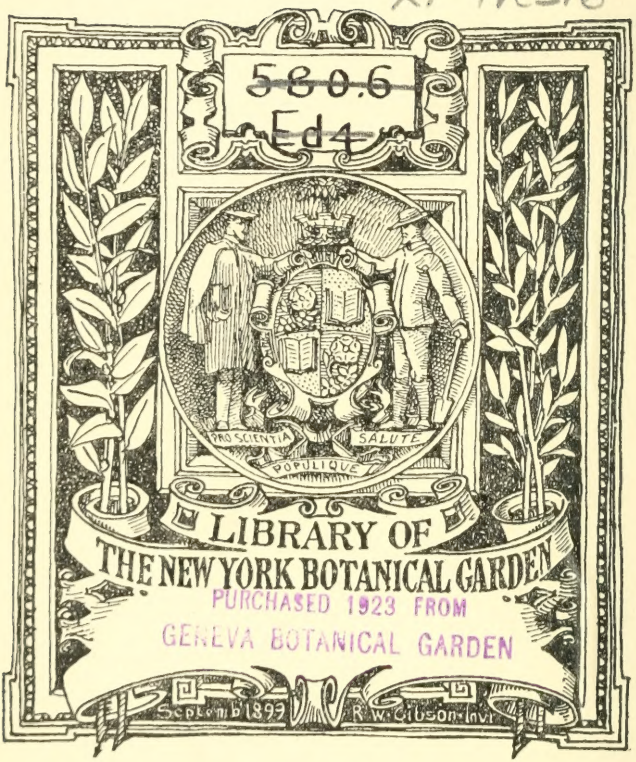

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VENDU EN 1922

TRANSACTIONS AND PROCEEDINGS

OF THE

BOTANICAL SOCIETY OF EDINBURGH.

VOLUME XXV.

DUPLICATA DE LA BIBLIOTHÈQUE
DU CONSERVATOIRE BOTANIQUE DE GENÈVE
VENDU EN 1922

CONSERVATOIRE BOTANIQUE VILLE DE GENÈVE

EDINBURGH:
PRINTED FOR THE BOTANICAL SOCIETY BY
NEILL & CO., LIMITED.
And to be obtained from the SECRETARY OF THE SOCIETY.
1910.

CONSERVATOIRE
BOTANIQUE
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1910

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THE DISTRIBUTION OF HEPATICÆ IN SCOTLAND

BY

SYMERS M. MACVICAR

PREFATORY NOTE

This work may be regarded as a new departure for Scotland in this branch of botany. The distribution of *Hepaticæ* in Scotland, as in England and Wales, has hitherto been given only in fragmentary form. Only an increasing interest in the study, and the accumulation of a large amount of material and information, have rendered a more detailed distribution possible.

For some years there has been an awakening of interest in the study of the *Hepaticæ* of the British Isles. The Moss Exchange Club, initiated fifteen years ago, and various publications, have stimulated this interest, and it is hoped that the issue of this volume will give a further impetus in this direction.

In 1904 there appeared a paper by the author in the *Annals of Scottish Natural History*, entitled a "Census of Scottish Hepaticæ." This was followed at intervals by other papers giving additions to the Census. Scotland is peculiarly rich in these plants, and several Scottish botanists have given attention to them. The discoveries of rare species have also attracted some English botanists, who have assisted by collecting in various parts of the country. The author has been investigating the flora for several years, with a view to the presentation of the facts set forth in the following pages.

Hitherto the distribution has been given by counties only, these having been distinguished by numbers. The present work gives the localities, with the collectors' names, of the older botanists whose specimens have been available for examination, as well as those of recent date. A few records have been taken from literature, but they have

been almost confined to works by specialists on the subject, and each of these records is indicated by a special mark in the context, as the specimens upon which they were founded have not been examined by the author, as have all the others with the exception of five or six which are marked "*in litt.*"

The author wishes to thank all those botanists who have sent plants for examination, also those who have afforded opportunities for the inspection of Herbaria.

Invermoidart, Acharacle,
Argyll, *August* 1910.

THE DISTRIBUTION OF HEPATICÆ IN SCOTLAND

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HISTORICAL

The first author who appears to have mentioned Scottish *Hepaticæ* is Sir Robert Sibbald (1641–1722). In his *Scotia Illustrata*, 1684, he gives *Marchantia polymorpha*[1] and *Pellia epiphylla*, also another thalloid species of which the identity is doubtful, and *Plagiochila asplenioides*.

Nearly a hundred years later, in 1772, the Rev. John Lightfoot (1735–88) travelled through Scotland with Pennant, and gave the botanical results of the tour in his *Flora Scotica*, 1777. In this work the following additional *Hepaticæ* are given:—*Riccia glauca?*, *Targionia hypophylla*, *Preissia quadrata*, *Conocephalum conicum*, *Aneura pinguis*, *Metzgeria furcata*, *Blasia pusilla*, *Gymnomitrium concinnatum*, *Lophocolea bidentata?*, *Chiloscyphus polyanthos*, *Cephalozia bicuspidata*, *Calypogeia Trichomanis*, *C. fissa*, *Lepidozia reptans*, *Anthelia julacea*, *Diplophyllum albicans*, *Radula complanata*, *Pleurozia purpurea*, *Madotheca platyphylla*, *Frullania Tamarisci*, and *F. dilatata*. His *Jungermannia lanceolata*, *J. viticulosa*, *J. quinquedentata*, *J. undulata*, and *J. resupinata* are too uncertain to identify. With his *Pleurozia purpurea* he has confused *Scapania purpurascens*, as can be seen from the habitats given. This mistake has also been made by more recent botanists.

James Dickson (1738–1822) made numerous additions to the British *Jungermanniæ*, according to Hooker. He published the *Fasc. Plant. Crypt. Brit.*, 1–4, in 1785–1801.

[1] The modern names are here used.

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His additions to the *Hepaticæ* of Scotland appear to have been *Aneura multifida?*, *Marsupella emarginata*, *Haplozia cordifolia*, *Sphenolobus minutus*, *Plagiochila spinulosa*, *Nowellia curvifolia*, *Chandonanthus setiformis*, *Herberta adunca*, *Ptilidium ciliare*, and *Trichocolea tomentella*. His *Anthoceros multifidus* is most probably *Aneura multifida* as Hooker supposes, although Withering received specimens from Dickson and considered the plant to be an *Anthoceros*. The habitat "crevices of rocks in the Highlands" would suit the common Scottish form, *Aneura multifida* var. *ambrosioides*, with which it is probable that Withering was not familiar; it would not suit *Anthoceros*. Regarding Dickson's *Riccia spuria* and *Jungermannia Thuja*, Mitten made the following note in 1906 in a copy of the *Census Catalogue of British Hepaticæ* in reference to the *J. Thuja*: "A specimen of Dickson's was sent to him by Menzies and is the N.W. American species. It was not Dickson's way to care about localities; thus he placed in 'Alp. Scot.' as a sort of refuge for anything he had forgotten, such as . . . . and the Malayan *Carpolipum spurium*, his *Riccia*, with the figure of which there is no fault to find."

Archibald Menzies (1754–1842) added *Pellia endiviæfolia* and *Madotheca Thuja?*

George Don (1764–1814) added *Anastrophyllum Donianum*, *Harpanthus scutatus*, and *Scapania ornithopodioides*.

Charles Lyell (1767–1849) appears to have been the first who found the following in Scotland:—*Pallavicinia hibernica*, *P. Flotowiana*, *Haplomitrium Hookeri*, *Nardia hyalina*, *Haplozia crenulata*, *Lophozia Muelleri*, *L. excisa*, *L. gracilis*, *Leptocyphus anomalus*, *Cephalozia Francisci*, *Saccogyna viticulosa*, *Scapania compacta*, and *Lejeunea cavifolia*.

Thomas Drummond (d. 1835) added *Gymnomitrium obtusum*, *Jamesoniella autumnalis* var. *Schaderi*, *Lophozia alpestris* var. *gelida*, *Sphenolobus Kunzeanus*, *Cephaloziella stellulifera*, and *Scapania subalpina*.

Thomas Hopkirk (1785–1841), the author of *Flora Glottiana*, 1813, added *Lophozia incisa* and *Diplophyllum obtusifolium*.

Sir William Jackson Hooker (1785–1855). A new era in the study of *Hepaticæ* was inaugurated when the *British Jungermanniæ* was published in 1812–16—the date of each part is given by A. Gepp in *Journal of Botany*, 1906, p. 177. His *Flora Scotica* was published in 1821. I gather that Hooker added the following to our flora:—*Metzgeria pubescens*, *Haplozia sphærocarpa* var. *lurida*, *Anastrepta orcadensis*, *Leptocyphus Taylori*, *Cephaloziella byssacea?*, *Bazzania trilobata*, *B. triangularis*, *Pleurocladula albescens*, *Blepharostoma trichophyllum*, *Scapania umbrosa*, *Madotheca lævigata*, and *Cololejeunea calcarea*.

Robert Kaye Greville (1794–1866) published his *Flora Edinensis* in 1824. In this work the only hepatic not mentioned in Hooker's *Flora Scotica* is *Haplozia crenulata* var. *gracillima*. He added to the flora of Scotland, besides this variety, *Riccia fluitans*, *Reboulia hemisphærica*, *Metzgeria conjugata*, *M. hamata*, *Gymnomitrium corallioides*, *Jamesoniella Carringtoni*, *Lophozia cylindracea*, *Sphenolobus saxicolus*, *Cephalozia lunulæfolia*, *Mastigophora Woodsii*, *Scapania curta*, *Marchesinia Mackaii*, *Frullania microphylla*, and *F. germana*.

David Don (1799–1841) appears to have added *Odontoschisma Sphagni*.

George A. Walker-Arnott (1799–1866), Professor of Botany, Glasgow, does not seem to have made any additions to our flora, but I have not had the opportunity of examining his herbarium.

William Wilson (1799–1871), the author of *Bryologica Britannica*, 1855, appears to have added *Plagiochila tridenticulata*.

John Hutton Balfour (1808–84), Professor of Botany, Edinburgh, who made numerous botanical expeditions over the greater part of Scotland, did not, unfortunately for our subject, make a special study of *Hepaticæ*. Hence his only addition to our list appears to be *Anthelia Juratzkana*. He included a short list of hepatics in *Trans. Bot. Soc. Ed.*, vol. i., in a catalogue of plants gathered in the Outer Hebrides in 1841.

Alexander Croall (1809–85) collected in many parts of Scotland. His additions to the flora are:—*Riccia Les-*

carinata, *Nardia obovata*, *Cephalozia fluitans*, *Lepidozia Pearsoni*, *Diplophyllum taxifolium*, *Scapania Bartlingii*, *S. æquiloba*, *S. aspera*, *S. uliginosa*, *S. paludosa*, and *Radula Lindbergii*.

William Gardiner (1809?–52), author of *Flora of Forfar*, 1848, collected principally in the north-east of the country. I cannot find that he added any species to our flora except perhaps *Lophozia lycopodioides*.

Charles Howie (1811–99) collected mainly in Fife. He visited West Ross-shire in 1867 in company with Charles Jenner, when he found some interesting *Hepaticæ*, but he does not appear to have added any species to our flora.

George Dickie (1812–82), Professor of Botany, Aberdeen, the author of *Botanist's Guide to Aberdeen*, 1860, added *Anthoceros punctatus* probably, and *Hygrobiella laxifolia*.

James Cruickshank (*ca.* 1813–47) published a list of *Jungermanniæ* from the neighbourhood of Dumfries, in the *Phytologist*, 1842. He collected in various parts of Scotland, and added *Lophozia bicrenata* and *Pallavicinia Lyellii?*

Robert Mackenzie Stark (1815–73), the author of *Popular History of British Mosses*, 1853, added *Lepidozia pinnata*.

William Gourlie (1815–56) was the discoverer of *Jubula Hutchinsiæ* in Scotland.

George Jasper Lyon (1816–62) made the additions:— *Lophozia turbinata*, *Lophocolea heterophylla*, *Cephalozia connivens*, *Colurolejeunea calyptrifolia*, *Microlejeunea ulicina*, and *Lejeunea patens?*

Mr Adamson, of whom no particulars are available, first found *Pleuroclada albescens* var. *islandica* in Scotland.

William Wilson Evans (1820–85) added *Pallavicinia Blyttii*.

Peter Gray (1818–99) appears to have added *Fossombronia pusilla* and *Scapania irrigua*.

Alexander Osmond Black (d. 1864) discovered *Gymnomitrium crassifolium*.

Benjamin Carrington (1827–93) collected in various

districts in Scotland. He forms a landmark between the time of Hooker and Greville and the present, and advanced our knowledge of *Hepaticæ* greatly. His *British Hepaticæ*, so far as completed, was published in 1874–76. He discovered *Eremonotus myriocarpus* during one of his visits, and also added *Harpalejeunea orata* to the Scottish flora, probably also *Gymnomitrium crenulatum* and *Marsupella Boeckii*.

William Nichol (1836–59). A few of Dr Nichol's specimens appear to be incorporated in the Greville Herbarium, but otherwise no trace of them has been found. He was an acute botanist and may have been the first who found some of our species.

John Sadler (1837–82) added *Riccia bifurca?*

George Edward Hunt (1841?–73) discovered *Marsupella sphacelata* on the Cairngorms, and probably also added *Gymnomitrium alpinum* to our flora.

John Whitehead (1833–96) was the discoverer of *Marsupella nevicensis*.

John Sim (1829–1901) collected in the north-east counties and in Shetland. He added *Gymnomitrium adustum*, *Marsupella sparsifolia*, *Lophozia longidens*, *Cephalozia leucantha*, *Prionolobus Massalongi*, *Lepidozia trichoclados*, and *Frullania fragilifolia*.

Alexander M'Kinley appears to have added *Nardia minor* and *Plagiochila punctata*.

John Stirling Stirling (d. 1900) investigated the flora of Stirlingshire with Mr R. Kidston. He appears to have done most of the part which related to *Hepaticæ*.

Rev. John Fergusson (1836–1907) collected in various parts of the Highlands. His additions to our flora are *Fossombronia Wondraczekii*, *Marsupella ustulata*, *Haplozia atrovirens*, *Jamesoniella autumnalis*, *Harpanthus Flotowianus*, *Cephalozia pleniceps*, and *Scapania rosacea*.

Charles Scott (1864–1907) collected in several parts of the south of Scotland and in Argyllshire. He added *Marsupella Pearsoni* to our flora.

For most of the dates of the above deceased botanists I am indebted to the indispensable *Biographical Index of British and Irish Botanists*, by Britten and Boulger.

Mr William Evans, Edinburgh, has investigated several

of our south-east counties for hepatics, and has added *Cephaloziella myriantha* to the flora.

Mr Peter Ewing, Uddingston, has collected in many districts and has materially increased our knowledge of the distribution of the species in Scotland. He has added *Sphenolobus politus*, *Odontoschisma Macounii*, and *Scapania crassiretis*.

Rev. David Lillie, Watten, has investigated the flora of the extreme north of Scotland, especially that of Caithness. He has made the additions:—*Lophozia Kaurini*, *L. atlantica*, and *Anthoceros lævis*.

Mr James M'Andrew, Edinburgh, has done much excellent work, especially in the south of Scotland. He published a *List of the Hepaticæ of Kirkcudbrightshire* in *Trans. Dumf. Nat. Hist. Soc.*, 1887–90, also a list of the *Hepaticæ* gathered at Moffat in 1891. He has added to our flora *Fossombronia Dumortieri*, *Sphenolobus Pearsoni*, *Radula voluta*, and *R. aquilegia*.

Miss K. B. Macvicar, Edinburgh, has added *Calypogeia sphagnicola*.

Mr James Michie, Balmoral, added *Sphenolobus Hellerianus*.

Mr James Murray, formerly of the Scottish Lake Survey, discovered *Scapania nimbosa* in Scotland.

Mr George Stabler,[1] Levens, collected many species in the Balmoral district, and published a list of these in *Trans. Bot. Soc. Ed.*, 1902. He added *Lophozia guttulata* to the flora.

Mr William West, Bradford, has collected in various districts of Scotland. He has added *Gymnomitrium varians* and *Lophozia Wenzelii*.

Mr William Young, Kirkcaldy, has added several interesting species to the county lists from various parts.

Professor Weiss, Manchester, has added *Cololejeunea microscopica* to our flora.

The author has been working at the distribution of our *Hepaticæ* during the last twelve years and has made the additions to our flora:—*Aneura incurvata*, *Marsupella condensata*, *M. Sprucei*, *M. Jörgensenii*, *Nardia Breidleri*, *N. subelliptica*, *Lophozia heterocolpa*, *L. obtusa*, *Sphenolobus*

[1] Died January 1910.

quadrilobus, S. exsectus, Acrobolbus Wilsonii, Pedinophyllum interruptum, Leptocyphus cuneifolius, Lophocolea spicata, Geocalyx graveolens, Prionolobus striatulus, Cephaloziella Limprichtii, Adelanthus decipiens, Calypogeia suecica, Radula Carringtonii, Cololejeunea Rossettiana, Lejeunea Macvicari, Drepanolejeunea hamatifolia.

GENERAL NOTES ON THE FLORA

As *Hepaticæ* usually form only a small part of the vegetation of a country and are mostly confined to localities or habitats where there is a considerable amount of permanent moisture, which must generally also be combined with shelter, their occurrence is local and is much less general than is the case with mosses. For ecological classification they must be taken in conjunction with other Bryophytes to form subordinate communities or small patches of mixed vegetation. To this there is one exception, where hepatics may be considered as dominant, namely about the summits of some of our highest mountains, of which Ben Lawers is the most distinctive. Here we have what Warming terms "fell-field," where the mean temperature of the warmest month is low, rain and mist abound, the soil is cold and is never completely covered with vegetation. We find that near the summit of such a hill, hepatics, though occurring as scattered patches, form the dominant vegetation, and that we have thus an hepatic-formation. The patches are low, flat, or cushion-like, the plants being densely compact, the stems usually deeply buried in the soil, with only a small part above the surface; the leaves are nearly always imbricated and are mostly brown in colour. As most of the patches are formed by species belonging to the genus *Marsupella* and to the *Marsupella*-like section of *Gymnomitrium*, it may be named the *Marsupella* association. The species forming this association are *Marsupella ustulata, M. condensata, Gymnomitrium varians, G. crassifolium, G. adustum, G. concinnatum, G. corallioides, Nardia Breidleri, N. scalaris, Anthelia Juratzkana, A. julacea, Pleuroclada albescens,*

Diplophyllum albicans, and *D. taxifolium*, most of which are usually present. With these are seen a few species of laxer habit, growing among such mosses as *Dicranum falcatum*, notably *Lophozia alpestris*, *L. ventricosa*, and *L. Floerkii*, also occasionally a still larger species of xerophytic type in *Plilidium ciliare*.

This formation extends further down the northern and eastern sides of a mountain than down the southern or western, and especially in depressions where snow remains throughout part of the summer. On the summits of many of our highest hills the soil occurs only in patches, and on these patches hepatics are either dominant or are subordinate to mosses. A larger number of our hills, however, especially in the Gabbro and Torridon Sandstone districts, are practically without vegetation on their summits. Occasionally the summits and dry exposed ridges have a moss formation owing to the dominance of *Rhacomitrium lanuginosum*. In this case hepatics are almost absent. On many hills of rather less elevation, especially in schistose districts, the soil is completely covered with grasses on the summit, this being a "closed" formation instead of the only partially covered soil of the "fell-field."

On several of the hills on the western watershed of the Highlands between 1700 ft. and 2000 ft. alt., or sometimes slightly higher, there is an interesting association of species, mostly of the Atlantic type. These are *Mastigophora Woodsii*, *Jamesoniella Carringtoni*, *Scapania ornithopodioides* and more rarely *S. nimbosa*, *Anastrophyllum Donianum*, *Herberta adunca*, *Anastrepta orcadensis*, *Pleurozia purpurea*, and *Bazzania trilobata*. This may be named the *Mastigophora* association. It is found on shady, somewhat moist ground, usually either on rock ledges, or between boulders in rough ground among grasses and scattered plants of *Calluna* or *Vaccinium*. Frequent associates in the latter habitat are *Leptocyphus Taylori* and *Scapania gracilis*.

Some associations of hepatics are mentioned in the sketch of the Provinces, and a list of the Sphagnum-moor or peat-moss species is given in the section dealing with Habitats; but little has been done in Scotland among Bryophytes from an ecological point of view, and the investigation is

of a different nature from that of a floristic work such as this.

Comparatively few species in Scotland are confined to any particular habitat. This especially applies to the Highlands, where the humid conditions are so favourable for their existence, that we find them on different situations, such as on both rocks and trees, which in a less favourable country would be limited to one or the other of these positions. In a large part of the south of Scotland, and towards the east coast, the climate is drier, and various species are more limited to special habitats, as appears also to be the case on the Continent. The presence or absence of continual moisture is the ruling factor. A few species grow almost equally well under either condition, but the very great majority do not. To a few species dry soil or dry rock is necessary, but the prevalence of hepatics in any part of our country depends on there being a considerable amount of moisture. When withdrawn to any great extent, hepatics disappear. This is well seen in a district favourable for hepatics, as in the West Highlands, where species will be found in quantity in the natural woods, but when the woods are thinned the species decrease, their place being taken by mosses, in which group there are more xerophytes. Hepatics cannot withstand competition with mosses except in the most humid parts of woods. We see on tree stems and rocks on which the former have first taken hold, that a moss, as *Eurhynchium myosuroides*, perhaps follows, and the hepatics are choked. The effect of drainage is almost entirely to destroy the hepatic vegetation, except in the case of those which manage to find a suitable habitat at the moist side of the drain. They are scarce in the region of cultivation, this region being in large measure one of small rainfall and absence of shade, and likewise scarce in those districts of the subalpine region where the rock seldom appears on the surface, as over almost the whole of the upland parts of the Lowlands. They are generally plentiful over the whole of the uncultivated regions of the Highlands, where the rainfall is large, but are in small quantity usually on the south and west sides of hills, and plentiful on the north and east sides, this being a matter of moisture. Species are scarce on trees in the

drier and exposed districts, as transpiration is excessive, the only one which can be considered at all frequent in such a habitat being the xerophytic *Frullania dilatata*. The opposite condition is seen in the shady ravines of the West Highland coast-line, where the moist atmosphere and comparatively small amount of light hinder transpiration; here we find hepatics in quantity on the stems of trees as well as on rocks, etc. In moist soils the most important division is into those which are peaty and those which are not.

The geological formation of the rocks, except in the case of limestone, is almost a negligible factor, further than whether they form a soil retentive of moisture or not. The sandstone and volcanic rock districts, except granite, are nearly always poor in species, even in the most favourable climatic districts, while in schistose rock districts there are usually species in plenty. A few species are more frequent when there is some lime in the soil, but no species is confined to this soil in Scotland, unless it be in the case of *Metzgeria pubescens* and *Lophozia turbinata*. Also a few species, as *Nardia scalaris*, are rare on limestone. Two rare species, *Marsupella sparsifolia* and *Sphenolobus Pearsoni*, have only been found with us on granite, and *Chandonanthus setiformis* is much more common when on this formation. As with habitats so it is with geological formations: in our moist insular climate, so favourable for the growth of hepatics, species do not limit themselves to a particular kind of rock as they appear frequently to do in countries less favourable for these plants.

RAINFALL

As the distribution of hepatics is largely a question of climate, the amount of rainfall has an important bearing on the subject. We find in Scotland that hepatics are scarce in all districts which have less than an average of 30 in. of rain annually. These districts form a narrow border along the east coast from Caithness to Berwick. Here also there is in general little shelter, but strong dry

winds favouring transpiration are frequent. We find, however, that even where these latter unfavourable conditions are absent in the district of small rainfall, as in sheltered ravines or dens, hepatics are still scarce. It must be added that the rock formation in which these dens occur is in general less retentive of moisture than in the dens in the wetter district of the west coast, and therefore less suitable for hepatics, and probably also with less humidity; but even with similar rock character in the two sides of the country the scarcity of hepatics in the dens of the drier districts is striking. The deficiency in the number of species in the drier districts is not so noticeable as the general scarcity of hepatics. Prolonged search over a considerable tract of a dry district will result in the discovery of nearly as many species as in a wet district, leaving out of account the peculiar Atlantic species of the western side of the country, but there can be no comparison between the amount of hepatic vegetation present in each. A larger number of plants will probably be seen in a single day's ramble in a wet district than would be found during a year's searching over a much larger area of a dry district.

Lists of species made under different amounts of our average rainfall have not resulted in much matter of interest, but some general features may be given. There are about 145 species which have been found on the low ground, and of these, 93 have also been found, among other places, in the district under 30 in. Of the 145 species there should be excluded 23 Atlantic species of the west coast, and of the 93 there should be excluded 11 peat-moss species, as the latter being on permanently wet ground have a wide distribution independently of the annual rainfall. Also from the 145 species may be excluded four which have only been found in shady ravines, when in the drier districts, as the humidity must be considerably above the average. There are thus 82 species out of 118 which have been found in the drier districts, and a few of these are local and rare, but this applies to both factors. Taking into consideration the comparatively small area which there is under the 30 in., we see that the actual number of species in Scotland is not much affected by the rainfall.

It would be a very different matter if a census of the number of individual plants within equal areas of the dry and wet districts were taken.

The apparent absence of Atlantic species of *Lejeuneæ*, and some other species of the same type, from the low ground of South-West Scotland is most probably due to the small annual rainfall, as some of them occur in the neighbouring wetter districts at the foot of the hills, although further from the sea, the geological formation being the same. Few of the Atlantic species are found below 30 in. They are most common in that part of the coast which has between 50 and 70 in.

None of the following *Lejeuneæ* have been found under the 40-in. rainfall, viz. *calyptrifolia*, *microscopica*, *Macvicari*, *hamatifolia*, and *ovata*. To these should be added *L. minutissima*, but this species has only been found in two localities in Scotland and cannot be taken into account in this regard. It is not a purely Atlantic species, and it occurs in England, where it is less rare, in some localities under the 40 in.

Subalpine species are uncommon below 40 in. except in the proximity of mountains and in the extreme north, especially Shetland, where latitude has some effect. The peat-moss species, as already stated, have a wide range in rainfall. The subalpine species *Preissia quadrata*, *Lophozia Muelleri*, and *Scapania subalpina* have been found on moist ground in sand-dunes below the 30-in. rainfall.

LATITUDE

Latitude in Scotland hardly affects the actual presence of any of our low-ground species of hepatics except in the case of the thalloid genera of Southern type, *Riccia*, *Targionia* and the introduced *Lunularia* and perhaps a very few foliose species also of the same type, as *Bazzania trilobata*, *Madotheca lævigata*, and *Cephalozia Francisci*. The absence in the extreme north of some of our other low-ground foliose species is in all probability due to the absence of shelter, as they are all plants of moist sheltered

ground, especially in wooded ravines. With regard to the alpine species, the ecological conditions in the north of Scotland are unfavourable for their presence. There are, however, two or perhaps three species which occur in the Highlands on hills of a similar height to those in the Lowlands, and the apparent absence of which from the latter is probably due to latitude. The ecological conditions are likewise unfavourable in the extreme northern islands of Orkney and Shetland, so much so that no alpine species have been found on the former and few in the latter. Those which are found in Shetland descend to a lower level than on the mainland, but the lower limit of altitude does not appear to be appreciably affected by latitude on the mainland except to a very limited extent. The main factor which affects the lower limits on the mainland is that the ecological conditions on the West Highland coast are favourable for such downward extension, as is also the case with other countries of similar features, and this also applies to other forms of vegetation.

Our climate being insular, there is little difference between the extremes of temperature due to latitude, but there is a considerable difference on account of longitude. Along the whole length of the western seaboard there is hardly any appreciable difference of winter temperature, and this temperature considerably exceeds the winter temperature of the centre and east of the whole of Scotland, and, it may be added, of the similar districts in England. On the other hand, the summer temperature is higher, and there is a greater amount of sunshine, in the centre and east of Scotland in corresponding latitudes than there is on the west, and the amount decreases with latitude. We should thus expect to find that Southern species, which require greater summer heat, would reach a higher latitude on the east and in the centre of the country than on the west, and this is mostly the case; also that the Southern species which are affected by latitude in our country mostly belong to the thalloid group, which are dependent on a considerable amount of summer heat in the soil.

ATLANTIC SPECIES

THE Atlantic species of hepatics are those which are confined, or almost so, to the west coast of Europe, including a short distance inland and the Atlantic islands, a few extending along the Mediterranean, and still fewer being also found in subtropical and tropical America, the West Indies, and other parts of the world. These species are more plentiful in the British Isles than in other parts of Europe, some being only known from our island.

The first fact to be noted is that the prevalence of the Atlantic species in Scotland is, in general, proportionate to their proximity to the west coast; the further one goes eastward, the rarer they become. The actual proximity of the sea on the east coast does not favour their occurrence except in a very few cases to be afterwards mentioned. The distribution of *Hepaticæ* is mainly dependent on climate, the chief requisite being moisture. In the case of nearly all Atlantic species an absence of a low extreme of temperature is also necessary. This combination does not extend far from the west coast, and the distance to which it extends marks the point to which these species are prevalent. Next to moisture in the atmosphere the most important requisite is the physical condition of the soil. Where the nature of the rocks is such that their disintegration does not form a moist and retentive soil, it will be found that even under the otherwise most favourable conditions on the west coast Atlantic species are scarce or absent. This is very noticeable in ravines running through sandstone and some volcanic rocks. Nearly all species of hepatics are scarcer in such ravines, but the Atlantic species being the most delicate, are affected in a more marked manner.

The next point in treating of the distribution of these species is that too much importance must not be given to the watershed dividing Scotland west and east. Watersheds in themselves have no relation to the distribution of *Hepaticæ*, whatever they may have in the case of phanerogams. The north and east sides of the watershed, with their constantly moist ground, have hepatics in plenty,

while the dry sun-exposed south and west sides have few. An instructive instance can be seen where our main watershed divides Argyllshire to the west and Perthshire to the east, at the part of the latter county where its eastern watershed lies nearest to the west coast. This is at Tyndrum and Ben Laoigh. The west or Argyllshire side is dry and sun-exposed, with little suitable ground for hepatics, while the east and north sides, both belonging to the watershed of the German Ocean, have abundance of hepatics, among which are the characteristic Atlantic species *Leptocyphus cuneifolius*, *Mastigophora Woodsii*, *Scapania nimbosa*, and *Cololejeunea microscopica*, which have not been found elsewhere on our eastern watershed, with the exception of the *Scapania*, which has been found on one locality in East Inverness close to its western boundary. It is the proximity of the Atlantic, not the watershed, which is of consequence, provided that there is moisture and shelter for these species. It is only in places with such moisture and shelter that the low-ground species of the Atlantic type extend eastward from the west coast. These conditions prevail a short distance over the western watershed in the Trossachs, and this is the most eastern point in the centre of Scotland where the hepatic flora is rather western than eastern. Owing to the configuration of Scotland, especially with its south coast being practically on the Atlantic, longitudinal lines for the whole of the country cannot be satisfactorily quoted.

Those species of Atlantic hepatics which are confined to the mountains have in several cases a more extended distribution eastward. This is so principally with those which occur on moist rock ledges, some of which are found in the Aberdeenshire Grampians. The wet climate of the mountains approximates more to that of the west coast, and these species are able to withstand a considerable amount of cold. On the other hand, our only alpine Atlantic species confined to dry rocks, *Gymnomitrium crenulatum*, while it is a common plant on the west coast, becomes gradually rarer as it extends to the east, until it becomes exceedingly rare on the Aberdeen Grampians. There is very little sheltered ground on our north coast. None of the characteristic species of the west coast have been found

there, but one Atlantic species, *Pleurozia purpurea*, which affects wet exposed moors, is found in quantity in the northern parts of the mainland. The Atlantic species are in general scarce on the exposed Orkney and Shetland groups of islands, but they are more in evidence there than on the northern mainland.

Our Atlantic species may be divided as follows, as far as our knowledge of their distribution allows in the meantime.

1. Species known only on the western watershed:

Sphenolobus Pearsoni.	Colurolejeunea calyptrifolia.
Acrobolbus Wilsonii.	Cololejeunea minutissima.
Plagiochila tridenticulata.	Lejeunea Macvicari.
Adelanthus decipiens.	Drepanolejeunea hamatifolia.
Lepidozia pinnata.	Harpalejeunea ovata.
Radula voluta.	Marchesinia Mackaii.
R. aquilegia.	Jubula Hutchinsiæ.
R. Carringtonii.	Frullania microphylla.

Sphenolobus Pearsoni extends inland to the Kells range of hills in Kirkcudbrightshire. This minute subalpine and alpine species, which is apparently confined to granite, will perhaps be found on the Eastern Grampians. *Radula aquilegia* extends inland to New Galloway. *Harpalejeunea ovata* is more frequent inland and extends rather further than the others of its group.

2. Species also on the east coast near the sea-shore, but not inland:

Lophocolea spicata.	Frullania germana.

The first of these is almost confined on the west coast to rocks on the shore. The only known locality for it on the eastern side is in a ravine close to the shore in Berwickshire. The second is frequent on rocks on the shore of the west coast. Its eastern locality is on the Isle of May.

3. Species extending for a short distance over the western watershed into the eastern:

Plagiochila punctata.	Scapania nimbosa.
Leptocyphus cuneifolius.	Cololejeunea microscopica.
Mastigophora Woodsii.	

Plagiochila punctata extends further inland than the others, reaching to Killin. I should have felt inclined to include *Microlejeunea ulicina* here. It is a western species in Scotland, extending inland to the Trossachs, but it has been found in several places in the centre of Europe. It prefers a drier and less sheltered situation than the undoubted Atlantic species of its family, and is probably of a more robust constitution.

4. Species common on the west coast, continuing frequent in some parts of Central Scotland, but becoming very rare toward the east coast:

Metzgeria hamata.
Gymnomitrium crenulatum.
Lepidozia Pearsoni.
Scapania gracilis.
Plagiochila spinulosa.
Saccogyna viticulosa.
Pleurozia purpurea.

5. Subalpine and alpine species common to the western watershed and the Eastern Grampians:

Gymnomitrium crenulatum.
Marsupella Boeckii.
Jamesoniella Carringtoni.
Anastrophyllum Donianum.
Herberta adunca.
Scapania gracilis.
S. ornithopodioides.

Anastrophyllum appears to have its headquarters in the Eastern Grampians, unless further search shows this to be in Sutherland. *Herberta* seems to be confined in the Eastern Grampians to the Forfarshire hills. The *Marsupella* is a minute species with its distribution very imperfectly known. The others are much more plentiful on the western watershed. One recent addition to our flora, *Lophozia atlantica*, has been found only in a few localities. It cannot be classed at present in any of the above divisions.

Comparing the Atlantic species in Scotland with those in England and Ireland as regards their distribution, we find:

1. Species which occur in Scotland but have not been found in England and Wales:

Jamesoniella Carringtoni.
Anastrophyllum Donianum.
Acrobolbus Wilsonii.
Leptocyphus cuneifolius.
Mastigophora Woodsii.
Radula Carringtonii.
Pleurozia purpurea.
Lejeunea Macvicari.

2. Species which occur in Scotland but have not been found in Ireland:

Marsupella Boeckii.	Lophozia atlantica.
Jamesoniella Carringtoni.	Sphenolobus Pearsoni.
Anastrophyllum Donianum.	Lejeunea Macvicari.

3. Species found in England, but not in Scotland:

Dumortiera irrigua.

4. Species found in Ireland, but not in Scotland:

Dumortiera irrigua.	Bazzania Pearsoni.
Plagiochila ambagiosa.	Radula Holtii.
P. Owenii.	Lejeunea flava.
P. killarniensis.	L. Holtii.
Cephalozia hibernica.	Microlejeunea diversiloba.
Adelanthus dugortiensis.	

Probably all the European Atlantic species, with the exception of *Scapania Jörgensenii* from Norway, have been found in the British Isles, and the following have not been found elsewhere in Europe:

Acrobolbus Wilsonii.	Radula Holtii.
Plagiochila ambagiosa.	Lejeunea flava.
Cephalozia hibernica.	L. Holtii.
Bazzania Pearsoni.	L. Macvicari.
Scapania nimbosa.	Microlejeunea diversiloba.
Radula voluta.	Frullania microphylla.

To these might be added *Metzgeria hamata*, *Jamesoniella Carringtoni*, *Mastigophora Woodsii*, *Cololejeunea microscopica*, and *Frullania germana*, which have been found elsewhere only in the Faroe Islands. The flora of these islands is generally admitted to be British rather than Continental. It will be noticed that seven of the species peculiar to the British Isles have been found only in Ireland.

The species common to the west of Norway and west of France are:

Plagiochila punctata.	Saccogyna viticulosa.
P. spinulosa.	Adelanthus decipiens.
Lepidozia pinnata.	Harpalejeunea ovata.
Scapania gracilis.	

Norway has the following which have not been found in France:

Gymnomitrium crenulatum.
Marsupella Boeckii.
Anastrophyllum Donianum.
Sphenolobus Pearsoni.
Plagiochila tridenticulata (as P. exigua).
Leptocyphus cuneifolius.
Herberta adunca.
Scapania ornithopodioides.
Radula aquilegia.
R. Carringtonii.
Pleurozia purpurea.

The following have been found in France but not in Norway:

Dumortiera irrigua.
Lophocolea spicata.
Colurolejeunea calyptrifolia.
Cololejeunea minutissima.
Drepanolejeunea hamatifolia.
Marchesinia Mackaii.
Jubula Hutchinsiæ.

The Atlantic species are the most interesting of our *Hepaticæ*. They differ from our other groups, Northern, Continental, and Mediterranean, in that their origin in our country cannot be traced to any known geological period. The peculiar British species, and some of the others, are subtropical or tropical. They are the relics of an early warmer period. Comparatively few have been found in fruit, and as gemmæ are also unknown in some of them, they are in many cases no doubt in process of extinction. Further investigation will doubtless alter our views on some of these species, and it is with some hesitation that I have included the generally accepted Atlantic species *Gymnomitrium crenulatum* and *Herberta adunca*, as they have been recorded from Alaska. Perhaps all alpine Atlantic species may be found to be in a different category from the species peculiar to sheltered places on the low ground, but here as with other groups there are always a few species which are difficult to classify.

WESTERN SPECIES OTHER THAN ATLANTIC

Most of the low-ground species are found in greater abundance on the west side of the country than on the east, but the following show a distinct preference for the west side:

Marsupella Funckii.
Sphenolobus exsectus.
Harpanthus scutatus.
Bazzania trilobata.
Trichocolea tomentella.
Madotheca lævigata.
Lepidozia trichoclados.

Also the following, which are sometimes considered to be Atlantic species:

Anastrepta orcadensis.
Sphenolobus ovatus.
Calypogeia arguta.
Microlejeunea ulicina.

With these must be included two alpine species, *Gymnomitrium obtusum* and *G. alpinum*.

The above species are either Western Continental, *i.e.* most prevalent in the western part of Europe, or are species which at least prefer the moister regions of Europe. *Sphenolobus exsectus* is a recent segregate with an imperfectly known distribution; it may perhaps have to be excepted.

EASTERN SPECIES

THE following species show a preference for the eastern side of the country, especially to the north of the Forth. A few are confined to that side, but are rare, having been found only in a few localities, and have been mostly added to our flora in recent years:

Riccia crystallina.
R. fluitans.
Lunularia cruciata.
Targionia hypophylla?
Haplozia cordifolia.
Lophozia turbinata.
L. badensis.
L. guttulata.
L. longidens.
L. cylindracea.
L. Floerkii.
L. Baueriana.
L. gracilis.
Sphenolobus Hellerianus.
Lophocolea bidentata.
L. cuspidata?
L. heterophylla.
Cephalozia Francisci.
Ptilidium ciliare.
P. pulcherrimum.
Diplophyllum obtusifolium.
Scapania paludosa.
Radula Lindbergii var. germana.
Madotheca platyphylla.
M. rivularis.

These are mostly of the Continental, as distinct from the Western Continental, type. The more common occurrence

of *Lophozia turbinata* and *L. badensis* is doubtless due to the greater area of soil containing lime on the eastern side of the country. A few arctic-alpine species have been found only on the Breadalbane mountains, but they are not taken into account in this connection, as the well-known richness of that district in all groups of plants renders comparison with other districts misleading from a geographical point of view.

HABITATS

An exact line of demarcation cannot be drawn between xerophytes, mesophytes, hydrophytes, etc.; a combination of two of the terms is necessary in several cases; also the typical form of a species may belong to one class, while its varieties may belong to another. The term hemixerophyte is used here for those species which are found on rather dry rocks and on the bark of living trees, but which can only survive in an almost continually moist atmosphere. Several of the species which have xerophytic characters, such as water-holding sacs, are found to be most prevalent in moist localities. Lithophytes being closely related ecologically to epiphytes, we find some species which belong to both groups; these may either grow indifferently on rocks or trees, or occur commonly on one and rarely on the other, and this relationship may alter according to the local conditions, and is not necessarily the same in different counties.

1. Species confined, or almost confined, to rocks. Xerophytes—*Gymnomitrium crenulatum*, *G. alpinum*, *Chandonanthus setiformis*, *Cololejeunea calcarea*, *C. Rossettiana*, *Marchesinia Mackaii*. Hemixerophytes—*Cololejeunea microscopica*, *Frullania microphylla*. Mesophytes—*Marsupella Boeckii*, *M. sparsifolia*, *Lophocolea spicata*, *Radula voluta*, *R. Carringtonii*. Hygrophytes—*Marsupella nevicensis*, *Jubula Hutchinsiæ* Some of these invariably grow directly on the rock, others are occasionally epiphytes on mosses.

Some species which are almost entirely confined to rocks when at a low altitude are frequently found on soil when

at high altitudes: *Gymnomitrium concinnatum* is a conspicuous instance of this.

2. Species occurring on living trees. XEROPHYTES—*Metzgeria furcata, Ptilidium pulcherrimum, Sphenolobus ovatus, Radula complanata, Cololejeunea minutissima, Microlejeunea ulicina, Frullania dilatata.* HEMIXEROPHYTES—*Metzgeria conjugata, Acrobolbus Wilsonii, Plagiochila punctata, P. spinulosa, P. tridenticulata, Leptocythus cuneifolius, Adelanthus decipiens, Madotheca laevigata, Cololejeunea calyptrifolia* (very rarely), *Lejeunea patens, L. Macvicari, Drepanolejeunea hamatifolia, Harpalejeunea ovata.* MESOPHYTES—*Lepidozia reptans, Scapania gracilis, Lejeunea cavifolia, Frullania Tamarisci, F. germana.*

None of the above are confined to trees, but *Leptocythus cuneifolius, Lejeunea Macvicari,* and *Microlejeunea ulicina* are very rare on other habitats.

3. Species occurring on stumps and decaying logs. MESOPHYTES—*Aneura latifrons, A. palmata, Lophozia ventricosa* and var. *porphyroleuca, L. guttulata, L. incisa, L. gracilis, Sphenolobus minutus, S. Hellerianus, S. exsectus, S. exsectaformis, Leptocyphus Taylori, L. anomalus, Lophocolea cuspidata, L. heterophylla, Cephalozia connivens, C. lunulæfolia, C. leucantha, C. serriflora, Nowellia curvifolia, Cephaloziella Starkii, C. trivialis, Odontoschisma denudatum, Calypogeia Trichomanis, C. fissa, C. suecica, Lepidozia reptans, L. trichoclados, L. setacea, Scapania gracilis, S. umbrosa, Ptilidium pulcherrimum, P. ciliare.*

Of the above, *Lophozia guttulata, Sphenolobus Hellerianus,* and *Calypogeia suecica* have been found only on decaying logs or stumps.

Some species are confined to decaying wood when on the east coast, but when on the west coast they also occur on peat.

4. Species occurring on loamy or turfy banks. Many species are found on this habitat, nearly all being mesophytes: the following are xerophytes: *Lophozia incisa* var. *Limprichtii, L. hicrenata, Sphenolobus exsectaformis, Cephaloziella Starkii.*

5. Species occurring on moist fallow ground. *Riccia*

glauca, *R. sorocarpa*, *R. Lescuriana*, *Pellia epiphylla*, *Fossombronia Wondraczekii*, *F. pusilla*, *Anthoceros laevis*, *A. punctatus*. These are all mesophytes.

6. Species occurring in Sphagnum-moor (peat-mosses). *Aneura pinguis*, *A. multifida*, *A. latifrons*, *Lophozia inflata*, *L. ventricosa*, *L. incisa*, *Leptocyphus Taylori*, *L. anomalus*, *Cephalozia bicuspidata*, *C. connivens*, *C. lunulafolia*, *C. leucantha*, *C. fluitans*, *Cephaloziella trivialis*, *Odontoschisma Sphagni*, *Calypogeia Trichomanis*, *C. fissa*, *C. sphagnicola*, *Lepidozia setacea*, *Pleurozia purpurea*. These are mesophytes with the exception of *Cephalozia fluitans*, which is a hydrophyte, as is also sometimes *Lophozia inflata*.

On moist bare peat on low-lying moors are found *Nowellia curvifolia* and *Odontoschisma denudatum*, both of which are mesophytes.

7. In marshes and springs several species occur; these are included under Helophytes by Warming. Characteristic species are *Aneura pinguis*, *A. multifida*, *Pellia Neesiana*, *Lophozia Wenzelii*, *L. Kunzeana*, *Sphenolobus politus*, *Chiloscyphus pallescens*, *Harpanthus Flotowianus*, *Scapania uliginosa*, and *S. irrigua*.

ALTITUDES TO WHICH SPECIES ASCEND

Ascending above 4000 *ft.* (1216 *metres*)

Metzgeria pubescens.
Gymnomitrium concinnatum.
G. varians.
G. crassifolium.
G. alpinum.
Nardia scalaris.
Lophozia alpestris.
L. ventricosa.
L. quinquedentata.
L. lycopodioides.
Lophozia Floerkii.
L. Kunzeana.
Plagiochila asplenioides.
Bazzania triangularis.
Pleuroclada albescens.
Blepharostoma trichophyllum.
Anthelia julacea.
A. Juratzkana.
Ptilidium ciliare.
Diplophyllum albicans.

Ascending to 3000–4000 *ft.* (912–1216 *metres*)

Conocephalum conicum.
Marchantia polymorpha.
Aneura pinguis.
A. multifida.
Pellia epiphylla.
P. Neesiana.
Blasia pusilla.
Pallavicinia Blyttii.
Gymnomitrium obtusum.
G. corallioides.
G. adustum.
Marsupella condensata.
M. nevicensis.
M. Boeckii.
M. ustulata.
M. sparsifolia?
M. sphacelata?
M. Sullivanti.
M. emarginata.
M. aquatica.
Nardia obovata.
N. subelliptica.
N. Breidleri.
Haplozia cordifolia.
H. riparia.
H. atrovirens.
Anastrophyllum Donianum.
Lophozia inflata.
L. Muelleri.
L. bantryensis.
L. Wenzelii.
L. incisa.
Lophozia quadriloba.
Sphenolobus politus.
S. saxicolus?
S. minutus.
Anastrepta orcadensis.
Leptocyphus Taylori.
Harpanthus Flotowianus.
Cephalozia bicuspidata.
C. Lammersiana.
Hygrobiella laxifolia.
Eremonotus myriocarpus.
Odontoschisma Macounii.
Cephaloziella Starkii.
Calypogeia Trichomanis.
Lepidozia reptans.
L. setacea.
Diplophyllum taxifolium.
Scapania subalpina.
S. æquiloba.
S. gracilis.
S. crassiretis.
S. purpurascens.
S. undulata.
S. obliqua.
S. uliginosa.
S. paludosa.
S. rosacea.
Radula Lindbergii var. germana.
Madotheca rivularis.
Lejeunea cavifolia.
Frullania Tamarisci.

Ascending to 2000–3000 *ft.* (608–912 *metres*).

Metzgeria conjugata.
Gymnomitrium crenulatum.
Marsupella Sprucei.
M. Pearsoni.
Nardia compressa.
N. minor.
Haplozia sphærocarpa.
Jamesoniella Carringtoni.
Lophozia longidens.

L. barbata.
L. Baueriana.
Sphenolobus quadrilobus.
S. ovatus.
Plagiochila spinulosa.
Chiloscyphus pallescens.
Cephalozia pleniceps.
C. connivens.
C. lunulæfolia?
Odontoschisma denudatum var. elongatum.
Calypogeia fissa.
Chandonanthus setiformis.
Herberta adunca.
Mastigophora Woodsii.
Scapania aspera.
S. ornithopodioides.
S. nimbosa.
S. irrigua.
S. curta.
Radula complanata.
Cololejeunea calcarea.
Frullania fragilifolia.
F. dilatata.

There are thus 20 species, or about 9 p. ct. of our total number of 225, which ascend above 4000 ft.; 61, or about 28 p. ct., which ascend to 3000–4000 ft.; and 32, or about 14 p. ct., which ascend to 2000–3000 ft. This makes a total of 113, or half our species, which ascend above 2000 ft. Of the remainder there are upwards of 75, or a third of our flora, which do not, or rarely, ascend above 1000 ft. This leaves only 37 species with ascending limits commonly between 1000 and 2000 ft.

It will be noticed that few of our arctic-alpine species, of which a list is given elsewhere, ascend above 4000 ft. This is owing to the exposed and barren condition of the small area in Scotland above this elevation. Our highest mountain, Ben Nevis, with an altitude of 4406 ft. (1343 metres), is almost devoid of vegetation in its upper parts.

The descending limits of species vary greatly in an insular flora; they are given under the species in the body of the work.

COMPARISON WITH OTHER COUNTRIES

When the general similarity of the hepatic flora of the North Temperate Regions is remembered, it is to be expected that the flora of Scotland should differ from that of the Continent of Europe principally in the more plentiful occurrence of *Hepaticæ* in general, and in the presence or absence of a few species, the effects of its insular climate.

The insular conditions, mainly the moist equable climate and large rainfall, reach their maximum on the western border of the Highlands and in the Islands, and are in fact in large measure confined to that district. There we see a flora mostly resembling that of the west coast of Norway, but nowhere else on the Continent, except in a small degree in parts of the west coast of France, and probably also of Portugal; and in the latter countries the resemblance is caused rather by the presence of a few particular species than by the general flora. Throughout the greater part of Scotland the insular conditions have only a slight effect on the flora, and are seen in the presence of a few Western species, and of a few Southern species which require the absence of such low temperatures as are seen in the more central parts of Europe. The peculiarity of our western Highland flora is the presence of a group of plants belonging to genera, or even individual species, of tropical or subtropical type, in close proximity to subalpine or even occasionally to alpine species. This is seen in a much smaller degree on the west coast of Norway, and occurs nowhere else on the Continent. To our northern latitude, with its insufficiently heated soil, is due the absence of a few Central European species, also of several South European species, the latter almost wholly belonging to the thalloid group, especially to the *Ricciaceæ*.

The alpine flora is similar to that of the mountainous regions throughout Europe, but wanting in some of the higher arctic-alpine species. The resemblance is closer to that of the mountains of Scandinavia than to that of the southern half of Europe, but the difference is not great. The almost entire absence of limestone on our highest hills probably also accounts for the absence of a few arctic-alpine species which are found on the Continent.

The different views taken by botanists of the status of various plants are apt to cause some divergence when comparing the number of the species in countries. We may give 261 as the number of species known from the whole Britannic flora, and we find that 225 have been found in Scotland, 211 in England with Wales, and 178 in Ireland. The main difference between the Scottish flora

and that of the others lies in the presence of a considerable number of arctic-alpine species, and to a less extent in the absence of some species of a Southern type. Scotland possesses 30 arctic-alpine species, England with Wales 5, and Ireland only 1, viz. *Scapania uliginosa*, but of which I have not seen a specimen from that country. Ireland has a few lower alpine species of Northern type in *Gymnomitrium obtusum*, *Marsupella Sullivanti*, *Haplozia cordifolia*, *Lophozia alpestris*, *Anthelia julacea*, and of lower alpine species of Atlantic type in *Gymnomitrium crenulatum*, *Mastigophora Woodsii*, *Herberta adunca*, *Scapania nimbosa*, and *S. ornithopodioides*; while England possesses in addition the lower alpine species *Gymnomitrium alpinum* and *Marsupella Boeckii*, but is without *Mastigophora Woodsii*. The flora of these countries, with the possible exception of the highest mountainous part of Wales, can hardly be said to reach above the subalpine region. In comparison with the other parts of the British Isles, the arctic-alpine species confined to Scotland are:

Pallavicinia Blyttii.
Gymnomitrium corallioides.
G. varians.
G. crassifolium.
Marsupella condensata.
M. nevicensis.
M. sparsifolia.
Nardia Breidleri.
N. subelliptica.
Lophozia Kaurini.
L. heterocolpa.
L. obtusa.
L. Wenzelii.
Lophozia lycopodioides.
L. quadriloba.
L. Kunzeana.
Sphenolobus politus.
S. saxicolus.
Harpanthus Flotowianus.
Cephalozia pleniceps.
Odontoschisma Macounii.
Pleuroclada albescens.
Chandonanthus setiformis.
Anthelia Juratzkana.
Scapania paludosa.

The following are common to Scotland and England with Wales:

Gymnomitrium concinnatum.
G. adustum.
Diplophyllum taxifolium.
Scapania crassiretis.

Scapania uliginosa having been recorded from Ireland, must be considered as common to the whole British Isles.

Nearly all the Scottish subalpine species, excluding

those of the Atlantic type, have been found in England with Wales. The following are confined to Scotland:

Marsupella Sprucei.	Lophozia longidens.
M. Jörgensenii.	Geocalyx graveolens.
Lophozia guttulata.	Prionolobus striatulus.

These have been added to our flora within the last few years and will not probably remain peculiar to Scotland.

The following subalpine species which are common to Scotland and England with Wales have not been found in Ireland:

Marsupella ustulata.	Eremonotus myriocarpus.
M. Pearsoni.	Ptilidium pulcherrimum.
Haplozia atrovirens.	Scapania Bartlingii.
Sphenolobus Hellerianus.	Radula Lindbergii.

One rare subalpine species, *Pallavicinia hibernica*, is common to Scotland and Ireland, but has not been found in England or Wales.

The 36 species of the Britannic flora which have not been found in Scotland belong to the low ground, with the exception of one rare Atlantic species, *Adelanthus dugortiensis*, and they are almost all plants either of the warmer parts of Europe, or where there is at least a greater summer heat.

The following are confined in our islands to England or Wales:

Riccia nigrella.	Haplozia cæspiticea.
R. Michelii var. ciliaris.	H. lanceolata.
R. Crozalsii.	Plagiochila Stableri.
R. ciliata.	Prionolobus dentatus?
R. pseudo-Frostii.	Cephaloziella integerrima.
Sphærocarpus Michelii.	C. Baumgartneri.
S. californicus.	Calypogeia submersa.
Fossombronia Mittenii.	Anthoceros dichotomus.
	A. Stableri.

Of the above, *Calypogeia submersa*, *Ceph. integerrima*, and *Haplozia lanceolata* may be found to occur in Scotland. The remainder are less likely, being either of the Southern or Continental type. The *Prionolobus* is queried, as it is doubtful if it has been found in England, this

species having been confused with *P. Massalongi*. *Plag. Stableri* and *Anthos. Stableri* are endemic species, so far as yet known.

The following are common to England with Wales and Ireland:

Ricciocarpus natans.	Fossombronia cæspitiformis.
Aneura sinuata.	Prionolobus Turneri.
Pallavicinia Lyellii.	Cephaloziella elachista.
Petalophyllum Ralfsii.	Madotheca Porella.
Fossombronia angulosa.	

It will be noted that five of the above belong to the Atlantic-Mediterranean group.

All the species which are usually confined to the low ground in Scotland have been found in England or Wales, but the following low-ground species have not been found in Ireland:

Aneura incurvata.	Lophozia cylindracea.
Nardia minor.	Prionolobus Massalongi.
Jamesoniella autumnalis.	Cephaloziella stellulifera.
Lophozia badensis.	C. myriantha.

Some of these are small species which have probably been overlooked.

The hepatic flora of the Faroes may be considered as a poor edition of that of Scotland. The species, as here reckoned, only amount to 98, and they all occur and in greater quantity in Scotland, with the exception of one very distinct species, *Frullania Jackii*, which is also found in Norway and may occur in Scotland, and of the following: *Scapania geniculata*, which Jensen, in his account of the *Hepaticæ* of the islands, remarks is perhaps only an extreme form of *S. rosacea*; and *Radula commutata*, a badly understood plant which is perhaps included in our *R. Lindbergii*. On the other hand, the Faroes have five distinct species in common with Scotland which have not been found in Norway or elsewhere on the Continent, viz. *Metzgeria hamata*, *Jamesoniella Carringtoni*, *Mastigophora Woodsii*, *Cololejeunea microscopica*, and *Frullania germana*, all these being Atlantic species, three of them being large and easily observed. Norway has upwards of twenty arctic-alpine species which have

not been found in Scotland. In looking over their distribution as given by Kaalaas, it is noticed that almost all are confined, or nearly so, to the north, centre, or east of the country, being absent or very rare on the west side. Six of these species belong to the *Marchantioideæ*, viz. *Peltolepis grandis, Sauteria alpina, Clevia hyalina, Grimaldia pilosa, Asterella pilosa*, and *A. Lindenbergiana*. The probability is not great that any of them will be found with us. There is a greater likelihood of some of the foliose arctic-alpine species occurring in Scotland, though only one, *i.e. Gymnomitrium andræioides*—unless *Scapania Jörgensenii* be considered in this group—is a western species in Norway. There are also upwards of twenty low-ground species in Norway which have not been found with us. As with the arctic-alpine group, they are nearly all absent or rare in Western Norway. Belonging, as they mostly do, to the Continental type, our insular climate is less favourable for them; however, a few will probably be found. The flora of the drier districts of Scotland near the east coast, especially in the south-east counties, seems to approach in some degree, though less Continental, the low-ground flora of the Christiania district of Norway, but the resemblance is much less than that between the floras of the west coast of the two countries. Excluding species of the Atlantic type, we have a few low-ground species which do not appear to have been found in Norway, the most noticeable being *Targionia hypophylla, Pallavicinia Flotowiana, Fossombronia pusilla*, and *Lophozia turbinata*, these having their headquarters in the west and south of Europe. All our arctic-alpine species occur in Norway, and, as is to be expected, in much greater abundance there.

As to the general similarity of our flora to that across the Atlantic Ocean, we find that the New England States, where the hepatics are being well examined, the results being published by Evans in *Rhodora*, have 147 species at present known. Of these, 100, or nearly 68 p. ct., have been found in Scotland. The remaining 47 include 12 which have been found elsewhere in Europe. There are at the same time some striking differences in the floras, as in the apparent absence in New England of perhaps our

commonest species, *Nardia scalaris*, the rarity of the very common *Diplophyllum albicans*, and especially in the genus *Frullania*.

For the whole Dominion of Canada, the proportion of species in common with Scotland appears to be rather higher, about 71 p. ct. When we come to California the proportion is reduced to 47 p. ct. The two latter percentages will no doubt considerably alter when the floras have been more thoroughly examined.

SKETCH OF THE FLORA OF THE PROVINCES

West Lowlands

The region of cultivation in this district is mostly represented in the south of Dumfriesshire and the low-lying parts of Ayrshire, and in the Clyde valley below Lanark, the larger part of the area being moorland or hill-pasture. Oats cease to ripen at about 800 ft. in the Nith valley, and at the same altitude in general in that of the Clyde, the highest noted being at 850 ft. at Crawford. In this region to about 900 ft. are also found the linns or glens with mixed deciduous woods, except in the higher district of the Clyde, where natural wood is absent. Where rock is exposed in the uncultivated districts of this region, subalpine species are occasionally frequent; especially is this the case in the granite districts. In the cultivated region hepatics are very scarce. In fallow ground are found *Riccia glauca*, *R. sorocarpa*, *Lunularia*, *Marchantia*, *Pellia epiphylla*, and *Fossombronia pusilla*. On the side of ditches, in addition to the *Pellia*, are *Blasia pusilla*, *Haplozia crenulata* var. *gracillima*, *Calypogeia Trichomanis*, *C. fissa*, *C. arguta* rarely, *Cephalozia bicuspidata*, *Anthoceros punctatus*, *A. laevis*. On moist banks these species are also found, with *Nardia scalaris*, *Haplozia crenulata*, *Lophozia bicrenata*, *L. ventricosa*, *L. Floerkii* and *L. barbata*, *Cephaloziella Starkii*, *Scapania compacta*, and *S. curta* on drier ground. In the woods, excluding those at the side of linns, there are very few hepatics, *Frullania dilatata*, *Metzgeria furcata*, and *Lophocolea*

bidentata being the only frequent species. When the woods are near the base of the hills, though still at a low altitude, as below 500 ft., species are found to be more plentiful, and include *Frullania Tamarisci* in some quantity on trees, and several other low-ground species on moist banks.

In the wooded linns running through the cultivated region hepatics occur in considerable quantity, but the number of species is few. *Conocephalum conicum*, *Pellia epiphylla*, *Metzgeria furcata*, *Nardia scalaris*, *N. hyalina*, *Plagiochila asplenioides*, *Lejeunea cavifolia*, *Calypogeia fissa*, *C. Trichomanis*, *Scapania purpurascens* with at times *S. undulata*, form the bulk of the hepatic vegetation. Less frequent species are *Haplozia pumila*, *H. riparia*, *Calypogeia arguta*, and *Saccogyna viticulosa*. In some of the linns *Chiloscyphus* is found in quantity. When the linns are near the base of the hills, though at a low altitude, they have a more subalpine flora, with *Preissia quadrata* and *Marsupella emarginata* on the rocks.

The rocks on the sea-shore are mostly dry and have few species, the most interesting being *Saccogyna*, *Marchesinia Mackaii*, *Frullania fragilifolia*, *F. microphylla*, and *Madotheca Thuja*, all these, with the exception of the first, being rare.

Permanent pasture extends in the upper Clyde valley to about 1000–1100 ft., and gradually passes into hill-pasture and moorland. There is little change in the hepatic flora of the hills up to 1700–1800 ft., where *Vaccinium* and *Polytrichum* frequently occur in quantity; and if there be a cap of peat from about this altitude, and covering the summits, the characteristic species are *Leptocyphus Taylori*, *Lophozia incisa*, *Lepidozia reptans*, *Cephalozia lunulæfolia*, and *C. leucantha*. If there be no peat on the summits, hepatics are very scarce, there being little more than *Nardia scalaris* and *Diplophyllum albicans*. In the granite districts of Kirkcudbright, where the rock is frequently exposed, hepatics are much more plentiful on the hills, and the subalpine species are found to be frequent from 300–400 ft. upwards. In this district there are also a few alpine species, *Gymnomitrium concinnatum*, *G. obtusum*, *G. alpinum*, *Lophozia alpestris*, *Harpanthus*

Flotowianus, *Scapania rosacea* ?, and the var. *germana* of *Radula Lindbergii*. These species, with the exception of the first-named, which has been found in Moffatdale, are apparently confined in the West Lowlands to the Kirkcudbright hills. The hepatic flora of these hills has a considerable resemblance to that of the English Lake District, and this is not seen in any other part of the Lowlands.

The Atlantic species of the West Lowlands are found in much smaller quantity than in the West Highlands. They are almost all very rare in this province, and are mostly confined to the neighbourhood of the shore or to sheltered ravines in the south-west. The following have been found: *Metzgeria hamata*, *Sphenolobus Pearsoni*, *Plagiochila spinulosa*, *P. punctata*, *Lophocolea spicata*, *Saccogyna viticulosa*, *Lepidozia Pearsoni*, *Pleurozia purpurea*, *Madotheca Thuja*, *Scapania gracilis*, *Radula aquilegia*, *Cololejeunea microscopica*, *Harpalejeunea ovata*, *Frullania microphylla*, *F. germana*. There are also the usually Western species *Microlejeunea ulicina* and *Lejeunea patens*, and the Western and Mediterranean *Marchesinia Mackaii*.

The species which occur in peat-mosses are much the same over the whole of Scotland. In the low-lying peat-mosses of the Lowlands, a very few of the subalpine species, as *Leptocyphus Taylori*, are absent or very rare, while they are common in the low-lying mosses of the Highlands. Also in the West Highlands and Hebrides a conspicuous feature of many peat-mosses is the abundance of *Pleurozia purpurea*, this species being rare in the West Lowlands, absent from the East Lowlands, and mostly so from the East Highlands. With such exceptions, the constituents of the flora do not much differ, though their relative frequency may vary.

East Lowlands

A large part of this district is under cultivation. The hilly districts comprise the Pentland, Moorfoot, and Lammermoor Hills, running through the centre of the district, and a higher range forming the southern boundary, the highest

part being near the sources of the Tweed. In addition there are isolated igneous hills in various parts of the district, as Arthur's Seat, Berwick Law, Eildons, Rubers-law, etc. The limit of the cultivated region in the Edinburgh district is given by the late Robert Smith in his Botanical Survey as 1000 ft. In the Upper Tweed district I find the limit to be rather lower, oats ceasing to ripen above 850 ft. in the Broughton district and at 750 ft. at Crook.

In the cultivated ground there is the usual scarcity of hepatics, and the species are the same as those of the West Lowlands; but there is a considerable difference in the flora of the dens or linns, especially towards the coasts of the two districts. Besides the general fact throughout Scotland of subalpine species descending to a lower level on the west side of the country than they do on the east, it is found that where a hilly district is close to the coast, subalpine species descend to a lower level than on hills more remote from the coast; and as in the East Lowlands the hills only approach the coast at one point, while they do so to a considerable extent in the West Lowlands, subalpine species are rarely found at such a low level in the former as in the latter. A more important difference in the flora of the district is in the presence or absence of various species. There is almost an entire absence of Atlantic species in the East Lowlands, the species known being only five in number—*Lophocolea spicata,* found on one occasion in a coast ravine in Berwickshire, *Scapania gracilis* and *Plagiochila spinulosa* in a few localities, the two latter species usually in a depauperate state, *Lepidozia Pearsoni* in one subalpine locality, and *Madotheca Thuja*, a Western and Mediterranean species, on rocks on the coast. The *Plagiochila* does not occur near the coast as it does on the West Lowlands, but is only found on the wetter subalpine region. Leaving out of account the special Western species, we find hepatics to be scarcer in general on the drier eastern side of the country than on the west. This is not so marked in the number of species present in both, as in the quantity in which they occur. The great majority of hepatics are so widely distributed that a mere enumeration of species in countries gives a misleading

idea of the flora. The number of species found in a day's walk on the west side may require a month's searching on the east side. The lesser number of peat-mosses in the south-eastern counties also gives fewer habitats for several species which affect this kind of ground. There are a few species more common on the east side of the country, the most noticeable being *Lophocolea heterophylla*, *L. bidentata*, *L. cuspidata* probably also, *Madotheca rivularis* and *M. platyphylla*.

The flora of the whole of the Southern Uplands may be divided by the valley of the Nith. To the north-east of this the hills are mostly composed of Silurian rocks; the broad rounded summits, descending gradually to the bottom of the valleys, seldom leave the rocks exposed. The flora of the Upper Clyde district, with its hills reaching from 1700–2400 ft., is the same as that of the Tweed valley where the hills are of a similar height: but at the watershed between the Tweed and Moffatdale the hills are more elevated, with a considerable amount of bare wet rocks on the surface, and here the flora is more distinctly subalpine, resembling to a great extent the subalpine flora of the Highlands. The hills to the south-west of the Nith valley are in several parts granitic, with much rock exposed in their gullies. Here subalpine species occur in quantity, and with them some Atlantic species. The summits of the hills being rounded without exposed rock as in those on the other side of the Nith valley, the uppermost flora is only subalpine in character, but a few alpine species are found on their flanks where the rocks are at the surface. This granitic district appears to more closely approach the alpine region than does the range at the watershed of the Tweed and Moffat valleys.

Limiting our remarks to the East Lowlands, we find that the hilly districts are almost confined to the Tweed valley. In this district, above the limit of cultivation, there is permanent pasture with hill-pasture to 1000 ft., or more frequently 1100–1200 ft., on which there is in general no change in the hepatic flora. At the latter altitudes the subalpine flora is characterised by the presence of *Nardia obovata*, *Lophozia quinquedentata*, *Blepharostoma trichophyllum* on rocks or rocky banks; and *Lophozia incisa*

and *Cephalozia leucantha* on peaty banks. At these altitudes also, *Nardia scalaris* begins to be found in quantity, *Aneura pinguis* with *A. multifida* sometimes common, and *Lophozia Muelleri* occasionally frequent; *Lophozia ventricosa* often becomes very common, and *Scapania purpurascens* more frequent. When the valleys descend from fairly high hills, as 1500–1700 ft., into dens or glens near their base, at the low level of 500 ft. or so, many of the subalpine species are found at this level. Also when a series of shaded rocks occurs in the course of a stream below 1000 ft., some of the subalpine species are also found there. Towards the head-waters of the Tweed valley in the parish of Tweedsmuir, which is in the centre of the most hilly district, subalpine species are found widely distributed from 950 ft. upwards. Besides the main range of hills in the East Lowlands, a few subalpine species are found on the isolated hills, and a very few on the sand-dunes on the coast.

On hills in which grasses form the predominant vegetation, hepatics are very scarce, and have no characteristic subalpine species, except in detached places where peat has accumulated, or on the banks of streams. On the hills which have a layer of peat on the higher parts we find on the peaty banks *Leptocyphus Taylori*, *Cephalozia leucantha*, *C. lunulæfolia*, *Lophozia incisa*, *Lepidozia setacea*, *Calypogeia Trichomanis*, etc. The height at which the peat is found varies greatly. It is found in quantity at the lowest altitude of 1000–1200 ft. towards the watershed of the Tweed and Moffat dales.

Eastern Highlands and Fife

The district here given is of large extent, but from the great similarity of its hepatic vegetation it may be taken as a whole. There is a broad belt of cultivated ground towards the coast—this includes most of Fife—and which extends over most of the district up to 800–900 ft. alt., but in the north-west this belt becomes narrower and does not extend as high. Above this, the subalpine region has comparatively few species in the dryer parts of the district, but becomes rich in species as it approaches the higher

hills and in the districts westward with their higher rainfall. The alpine region comprises the Grampians and the mountains forming the watershed between East Inverness and West Ross and part of West Inverness. There is not much difference in the flora of the various parts of the Grampians further than due to the larger amount of granite in the Cairngorm range, and the well-known richness of the Breadalbane range in all classes of alpine plants, to which must be added the presence of a partially Atlantic flora at its extreme western limit, and of a few Atlantic species at the eastern part of the Grampians, but apparently absent from the centre of the range. The East Inverness watershed, as limited above, is close to the west coast, and, as far as it has been examined, is largely of a Western type.

The cultivated region, as elsewhere, is poor in species. The ravines running through it have in general a rather richer flora than is seen in the East Lowlands, but it is only above this region that the much greater richness of the flora is marked. The subalpine region extends to about 2000 ft.; above this the alpine region reaches to 3500–4000 ft. Proximity to a high alpine region always gives richness to the subalpine flora, due in part, perhaps, to the greater rainfall in such a region. On the subalpine moors remote from the higher hills, the number and quantity of species is not great, and is much poorer than in the wetter West Highlands. A feature of the East Highlands which is almost absent from the West Highlands is the presence of subalpine woods of native Scots pine. On the decaying logs and stumps of these are found a few species, as *Sphenolobus Hellerianus*, which are absent or rare on the west side of the country. The alpine region of the Grampians is rich in species, several being found only in this district. The presence of much glacier drift at high altitudes allows of the presence of moist retentive soil favourable to the growth of hepatics. In wet ground between 2000 and 3000 ft. *Lophozia hantryensis* in quantity, *Harpanthus Flotowianus*, *Sphenolobus politus*, *Scapania uliginosa*, *S. paludosa*, and *Haplozia cordifolia* in large masses, are characteristic species. On moist soil near the summits are several small species of

Gymnomitrium and *Marsupella*, with *Nardia Breidleri*, *Pleurocladia albescens*, *Anthelia Juratzkana*, etc.

West Highlands

There is comparatively little cultivated ground in the West Highlands, this being limited to a narrow fringe along the shores, and running along the bottom of the glens. The hills descend usually steeply to the shores, so that there is little drift, and the rock is close to the surface. The cultivated area hardly extends above 500 ft. alt., most being below 300 ft. alt., the parts above this being generally cultivation of former days. Most of the glens are narrow with steep sides, but in a few of the larger glens, as the Spean and Orchy, the sides are less steep for a considerable distance, there being a considerable amount of drift forming soil suitable for cultivation. The upper limit at which oats ripen in such glens is about 600 ft., the highest in Glen Spean being at Inverlair Farm about 600 ft., and at Achallader Farm, Glen Orchy, at about the same altitude. Mixed deciduous woods of oak, rowan, willow, and birch extend up to 600–700 ft. in ravines, the larger part being birch. This last tree forms patches of woods by itself in corries up to 1300–1400 ft. where sufficiently sheltered, but it is usually under 1000 ft.

As in other parts, there are few *Hepaticæ* in the cultivated districts, but the West Highlands differs from the East Highlands and from the South Lowlands in having its mountainous regions extending to the coast, the result being that within the same altitude as the cultivated region there is steep rocky, hilly ground with its hepatic flora composed in large part of subalpine species. In the East Highlands the subalpine species more seldom descend into the cultivated region, except in the inland glens which lie at the foot of mountains, and in peat-mosses and isolated hills. Also on the steep rocky hills, especially when isolated, several alpine species descend into the subalpine region. In a few instances alpine species descend into the subalpine region in the East Highlands, but in the West Highlands it is the rule on the steeper hills.

The low-ground hepatic flora of the West Highlands,

excluding the species of cultivated ground, which do not differ from those of other districts, may be divided into those inhabiting the low-lying peat-mosses, the bare grassy or peaty slopes, and the steep natural-wooded hillsides. A few species are also almost confined to rocks and banks on the shore. The characteristic Atlantic species are mostly found in the wooded slopes and ravines, especially in the latter, where there is a greater degree of permanent moisture. They are most abundant in localities close to the shore, but are also frequent when the slopes are those bordering a fresh-water loch, if little above sea-level and not far removed from the sea. Here are found the rare *Lejeunea*, *Metzgeria hamata*, *Adelanthus decipiens*, *Plagiochila spinulosa*, *P. punctata*, *P. tridenticulata*, *Leptocyphus cuneifolius*, etc., with the more generally distributed species such as *Trichocolea*, *Bazzania trilobata*, *Scapania umbrosa*, etc. The abundance of *Scapania gracilis* on the low ground and in the subalpine region is characteristic of the flora. The north and east slopes are moister than those on the south and west, and consequently have a more varied and luxuriant flora: but this does not apply to the ravines if sufficiently shaded with wood, as they remain damp in any exposure.

Here, as in other parts, the dry grassy slopes hardly have any species. On small banks are sometimes to be found *Nardia scalaris*, *Sphenolobus exsectaformis*, *Lophozia bicrenata*, *Lophocolea bidentata*, with the ubiquitous *Diplophyllum albicans*. On the wet slopes, when not peaty, a few marsh species are found, as *Pellia epiphylla*, *Aneura multifida*, and *Scapania irrigua*. The peaty slopes are mostly interspersed with wet rocks and old heather, and contain most of the peat-moss species, with *Scapania gracilis*, *Anastrepta orcadensis*, and *Bazzania tricrenata* in addition, the wet rocks being often coated with *Marsupella emarginata*, *Scapania undulata*, and *S. purpurascens*. The peat-mosses contain, besides those generally distributed in the low peat-mosses of other districts, *Aneura latifrons*, *Leptocyphus Taylori*, *Cephalozia leucantha*, and *Pleurozia purpurea*.

The species almost confined to shore rocks are *Lophocolea spicata*, *Marchesinia Mackaii*, *Frullania microphylla*, and

Madotheca Thuja. Subalpine birch-woods are frequent at the foot of corries from 500 ft. or 700 ft., extending to a limit of 1300–1400 ft., or rarely to 1700 ft. as in Choir Arder? Characteristic species are *Sphenolobus ovatus* on the trees, *Anastrepta orcadensis* on banks about the base of trees, with much *Scapania gracilis* and *Leptocyphus Taylori*.

On the slopes of the hills *Anthelia julacea* begins to occur in quantity on wet rocks and stony marshes at 800–1200 ft. At 1700–2000 ft. on rocky ledges, among boulders and on rocky banks with long heather and *Vaccinium*, is the characteristic locality for the alpine or upper subalpine Atlantic species *Jamiesoniella*, *Anastrophyllum*, *Mastigophora*, *Scapania ornithopodioides*, *S. nimbosa* (rarely), with *Pleurozia* in a more luxuriant state than in the lower-lying peat-mosses. With these are associated quantities of *Bazzania tricrenata* and *Herberta adunca*.

If the heather associates be taken as the limit of the subalpine region, as done by R. Smith in the Botanical Survey of the East Highlands, it may be considered to be at 1800 ft. alt. in the West Highlands. Above this, as is the case also in the alpine regions of the East Highlands, the characteristic species is *Gymnomitrium concinnatum* on rocks, with *G. obtusum*, although the latter frequently occurs in quantity also below this altitude. In this region are also found *Lophozia alpestris*, *Haplozia cordifolia*, *Scapania uliginosa*, *Anthelia Juratzkana*, etc. Most of the highest hills have little soil near the summit. On Ben Nevis between 3600 ft. and 4400 ft. are found the high arctic-alpine species *Gymnomitrium varians*, *G. crassifolium*, *Marsupella nevicensis*, *Nardia Breidleri*, and *Pleuroclada albescens* in the small patches of moist soil which are scattered over the upper parts.

Hebrides

The hepatic flora of the Hebrides is similar to that of the mainland of the opposite west coast, when allowance is made for the comparative scarcity of sheltered ground in the former, and the barrenness towards the summits of the highest hills in the Inner Hebrides, also, to some extent,

the more maritime climate. This last factor is greatly neutralised by the absence of shelter. The contrast between the flora of the Outer Hebrides and most of the islands in the Inner group, due to their different geological formation, and to the configuration of the land, does not apply to *Hepaticæ*, although readily observed in the case of phanerogams. The larger amount of sheltered ground in the Inner islands, the presence in some of them of limestone, the extreme barrenness of all the higher hills which have been examined, account for what difference there has been observed between the two groups. The stony summits of the Paps of Jura and Ben More in Mull are only equalled by the bare rocks of the Gabbro of the Cuchullin Hills in Skye, and doubtless also those of Rum.

The absence of shelter in the Hebrides has the usual result in scarcity of trees. Woods and copses are very local in the Inner group and almost absent in the Outer islands. Most of the species which occur in such situations on the west coast mainland have been found in the Inner Hebrides, but, as is to be expected, much more locally. Such species are also frequently found in sheltered ground among sea-cliffs, and in this way are also found to occur in the Outer islands. Atlantic species which require shelter, such as the small *Lejeuneæ*, are local; but where deep ravines or greatly sheltered rocks are present, as in parts of Mull, they are found plentifully. The more maritime climate of the islands portrays itself by the abundance of the few Atlantic species which do not require much shelter when on the west coast, such as *Saccogyna viticulosa* and *Frullania germana*. All the larger islands contain peat-mosses in more or less abundance, but in some of the smaller islands, as Tiree, what peat there was at one time has practically all been used as fuel, and in this way Tiree differs greatly from such an island as the neighbouring one of Coll.

North Highlands

As this district comprises the whole of the northern part of the mainland, we have both an eastern and western flora. The province has not been so widely examined as the others have, and this especially applies to the upper

part of the western side; but some districts have been well searched, and show that the eastern part has a similar flora to that of the East Highlands, while the western part is similar to that of the West Highlands. It is to be noted, however, that, this part of Scotland being much the narrowest part of the mainland, the western species are more commonly met with throughout the whole district than is the case further south; yet they are very scarce near the east coast. The watershed runs comparatively close to the western sea-board, so, as is to be expected, the western species extend for some distance into the eastern side. The rainfall is slight near the east coast, being mostly under 30 in., and is less than 40 in. for some distance inland. In the western part it is less than that of the West Highlands, but it is still over 40 in. in its driest part, which is the extreme north, and it is more than 50 in. over the greater part of the district. There is a considerable amount of cultivation in Caithness, but very little elsewhere except in the south-east corner of Ross-shire. This latter district has also a fair amount of woods, but in Caithness and in the northern part of the province generally natural woods are almost absent, owing to the want of shelter. To this is due the absence of some species which are found in the East Highlands.

In the southern part of the west coast of this province, the low-ground flora is quite similar to that of the West Highlands, and it is probable that there is little difference until the extreme north is reached, where there is little or no sheltered ground. On the north coast shelter is almost absent; the rainfall is also under 40 in. for almost the whole of its length. These conditions being unfavourable for the western species, we find they are almost absent in this part, the proximity of the sea not being sufficient in itself to counterbalance these disadvantages. In the exceptional case of a western species not requiring shelter and inhabiting wet ground, such as *Pleurozia*, we find it abundant on moors near the north coast.

The arctic-alpine flora, and the flora of the hills in general, of this province are poor in comparison with those of the East and West Highlands, especially those of the Breadalbane and Cairngorm Mountains, as the Torridon

Sandstone and gneissic rocks, of which most of the higher hills are composed, form little soil suitable for hepatics. The few hills of over 3000 ft. alt. in the schistose formation may be expected to yield a few species not yet recorded for this province, as may also the limestone of West Sutherland.

Orkney and Shetland

These islands have not yet been thoroughly searched for hepatics, but they do not seem to offer favourable conditions for this group of plants. Nearly the whole surface is wind-swept and without shelter, and the few hills which are present, except in the island of Hoy, are almost without partially sheltered corries descending to the low ground. There are some small sheltered gullies on the shore, especially in Shetland, which would repay examination, as in such places one might expect to find some species, as the smaller *Lejeuneæ*, a few of which have been found in the Faroes.

Arctic-alpine species appear to be absent in Orkney, the highest elevations, Ward Hill in Hoy, with an altitude of 1564 ft., and Culags, alt. 1426 ft., being very barren in the upper parts. A few arctic-alpine species have been found in Shetland, but the scarcity of wet ground and of exposed rock-surface on the more elevated parts gives few favourable localities. A detailed examination of the highest ground, Ronas Hill, alt. 1475 ft., would probably reveal the presence of some additional species. The summit of Saxa Vord, alt. 934 ft., at the extreme north of Unst, has no exposed rock-surface and has not yielded any alpine species. The few which have been found in Shetland have been at low elevations, and one species, *Harpanthus Flotowianus*, occurs at sea-level.

In the island of Hoy there are a few partially sheltered corries, and in these are found a more Western flora than in any part of the extreme northern mainland. This is especially noticeable in the abundance of *Plagiochila spinulosa* and in the frequent occurrence of *Saccogyna viticulosa*, the former being rare, and the latter not having been found in the other district. If Hoy be excepted, the Atlantic species seem to be more frequent in Shetland than in Orkney, and it is probable that further search will show

them to be considerably more so, but the scarcity of shelter will always prevent their being found in any great quantity. The most striking difference in the flora of the two groups of islands is the apparent absence of *Pleurozia* in Shetland, while it is abundant in Hoy, and has also been found elsewhere in Orkney. This is doubtless due to the want of suitable ground in Shetland, as the species is frequent in the Faroes and the northern mainland.

The Faroes have been so well searched for hepatics that a comparison with the less examined Shetland is at present unsatisfactory. Remarks on the comparative floras of the Faroes and the whole of Scotland are made in another section. In the meantime it may be noted that the hills in the Faroes ascend to a greater height than they do in Shetland, and for this reason the high arctic-alpine species *Pallavicinia Blyttii, Gymnomitrium corallioides,* and *Lophozia Wenzelii,* which are found in the former, will probably not occur in the latter, while all the Atlantic species of the Faroes should be found if shelter and suitable edaphic conditions are present. The following species and varieties have been found in Shetland but not in the Faroes:—*Aneura palmata, Pallavicinia hibernica, Marsupella Sullivanti, Nardia compressa, Haplozia crenulata* var. *gracillima, Lophozia bicrenata, Diplophyllum obtusifolium, Odontoschisma denudatum* (type), *Calypogeia arguta, Lepidozia pinnata, Scapania umbrosa, S. compacta, Frullania dilatata.* All the above, with the exception of *Mars. Sullivanti* and *Nardia compressa,* are almost confined to the low ground in Scotland, and are mostly of a somewhat Southern type of distribution. One plant, *Madotheca rivularis* var. *faroensis,* which Jensen discovered in the Faroes, has only been found in that group and in Shetland.

ARRANGEMENT AND SEQUENCE OF SUB-PROVINCES AND VICE-COUNTIES

I HAVE finally decided to use Watson's Sub-Provinces and Vice-Counties, with a few alterations, as the least objectionable arrangement for showing the distribution of

the species. Our eastern and western boundaries appear well marked when outlined on a map, but are not so in reality, as may be readily seen by anyone who attempts to define them in the field. As localities are given for the species, permanency is secured. The present county boundaries are here used. Stirling has been divided by the watershed into East and West, as it is an anomaly to place part of Loch Lomond in the East Highlands. With West Stirling is included the detached part of Dumbarton. The Glenfalloch watershed of Perth is placed in Dumbarton, and the sequence of some of the vice-counties is altered.

South-West Lowlands .	Dumfries; Kirkcudbright; Wigtown.
North-West Lowlands .	Ayr; Renfrew; Lanark.
East Lowlands . .	Peebles; Selkirk; Roxburgh; Berwick; Haddington; Edinburgh; Linlithgow.
South-East Highlands .	Fife and Kinross, East Stirling (eastern watershed); South Perth (the Perthshire part of the Forth basin) and Clackmannan; Mid Perth (Perthshire between South Perth and the rivers Tay and Garry, and railway line to border of Inverness-shire); North Perth (Perthshire north and east of these divisions).
Mid East Highlands .	Forfar; Kincardine; South Aberdeen; North Aberdeen (separated from the former by the watersheds east and west of Inverurie).
North-East Highlands .	Banff; Elgin; East Inverness (Nairn and Inverness east of N. and S. watershed of Scotland).

West Highlands . .	Kintyre (to Crinan Canal); Clyde Isles (islands in the Firth of Clyde); Dumbarton (with Glenfalloch watershed of Perthshire); West Stirling with detached part of Dumbarton; Argyll (Argyllshire between Loch Linnhe and Crinan Canal); West Inverness (Inverness west of the watershed, and Argyll north-west of Loch Linnhe).
Inner Hebrides . .	South Inner Hebrides (Islay, Jura, and adjacent islets); Mid Inner Hebrides (Mull, Coll, and adjacent islets); North Inner Hebrides (Skye, Rum, and adjacent islets).
Outer Hebrides.	
Lower North Highlands	West Ross (Ross and Cromarty west of N. and S. watershed); East Ross (Ross east of the watershed).
Upper North Highlands	East Sutherland (with drainage to the east); West Sutherland (with drainage to north and west); Caithness.
Orkney.	
Shetland.	

In the vice-counties are placed the localities of the species and names of collectors. In every case the specimen on which the record has been founded for each locality has been examined by me, except when the record has been taken from literature, and always in this case it is preceded by "*cf.*," also in some half-dozen records marked "*in litt.*" These records from literature have been here almost confined to those of a few specialists in *Hepaticæ*, as a consider-

able experience of the names given to specimens in Herbaria emphasises the fact that this group of plants has been much neglected in this country; and without wishing to suggest any special accuracy in my own examination of specimens, it is an advantage to have a uniform authority in the records. The first record given is the earliest of which I have seen a specimen from that vice-county. An examination of the collections at the National Herbarium, at Kew, and of Carrington's in Manchester, would doubtless give several earlier records for some of the vice-counties, though it would not probably add much to the knowledge which we now have of the distribution of the species.

The following are the sources from which the records have been derived:—

The Herbarium at the Royal Botanic Garden, Edinburgh, which I have had the opportunity of examining at leisure through the kind courtesy of Prof. I. B. Balfour. This Herbarium contains, besides several original specimens of Taylor's of much value, the Greville Herbarium, and specimens from the following Scottish botanists: J. Cruickshank, T. Drummond, W. Gardiner, W. Gourlie, P. Gray, W. Jackson, Rev. J. Kerr, G. J. Lyon, Dr W. Nichol, J. Sadler, R. M. Stark.

Prof. Dickie's Herbarium at Aberdeen, which Prof. Trail kindly sent me for examination.

A duplicate collection of Alex. Croall's hepatics.

The Herbaria of Charles Howie, John Sim (Strachan), John Whitehead, and the Rev. Dr Fergusson (Fern).

I have not been able to trace the specimens, if extant, of some of the other botanists of a former generation who have published records of Scottish hepatics, or access to them has not been available. During recent years, through the kindness of correspondents, it is probable that few specimens of interest have been gathered in Scotland which have not passed through my hands. I am also indebted to them for the loan of various specimens collected by the earlier botanists.

LIST OF COLLECTORS

J. Aimer, Dundee.
Prof. T. Barker.
W. H. Beeby.
W. Campbell (Campb.), Glasgow.
Dr B. Carrington (Carr.).
Ll. J. Cocks, Bromley.
Alexander Croall.
J. Cruickshank (Cruicks.).
Prof. Dickie.
H. N. Dixon, Northampton.
T. Drummond.
J. B. Duncan, Bewdley.
W. Evans, Edinburgh.
P. Ewing (Ew. or Ewing), Uddingston.
Rev. Dr J. Fergusson (Ferg.).
J. Fulton, Dundee.
W. Gardiner (Gard.).
W. J. Gibson (Gibs.), Stornoway.
Dr T. Gilmour (Gilm.), Islay.
R. K. Greville (Grev.).
Symington Grieve, Edinburgh.
W. P. Hamilton (Ham.), Shrewsbury.
E. M. Holmes, London.
Charles Howie (How.).
J. T. Johnston (Johns.), Moffat.
D. A. Jones, Harlech.
D. Kennedy (Kenn.), Invermoidart.
R. Kidston (Kids.), Stirling.
H. H. Knight, Cheltenham.
J. R. Lee, Glasgow.
Rev. D. Lillie, Watten.
C. Lyell.
G. J. Lyon.
J. M'Andrew (M'And.), Edinburgh.
J. Macrae, Kintyre.
C. M'Intosh (M'In.), Dunkeld.
Symers M. Macvicar (Macv.), Invermoidart.
Miss K. B. Macvicar (Miss Macv.), Edinburgh.
R. H. Meldrum (Meld.), Tibbermore.
J. Michie, Balmoral.
Alistair Murray (A. Murr.).
James Murray (J. Murr.), formerly of Scottish Lake Survey.
Dr W. Nichol (Nich.).
W. H. Pearson, Manchester.
C. Scott.
J. Sim.
G. Stabler (Stabl.).
R. M. Stark.
Col. Stirling (Stirl.).
William West (West), Bradford.
George West (G. West), Scottish Lake Survey.
J. A. Wheldon, Liverpool.
A. Wilson, Ilkley.
J. Whitehead.
W. Young, Kirkcaldy.
K. & S., R. Kidston and Col. Stirling.

WORKS QUOTED

Sibb. Scot. Ill. . .	Scotia Illustrated, 1684, by Sir Robert Sibbald.
Lightf. Fl. Scot. . .	Flora Scotica, 1777, by the Rev. John Lightfoot.
Dicks. Pl. Crypt. Fasc.	Fascicularis Plantarum Cryptogamarum, 1785–1800, by James Dickson.
Hook. Brit. Jung. .	British Jungermanniæ, 1812–1816, by Sir William Hooker.
Hopk. Fl. Glott. . .	Flora Glottiana, 1813, by Thomas Hopkirk.
Hook. Fl. Scot. . .	Flora Scotica, 1821, by Sir William Hooker.
Grev. Fl. Edin. . .	Flora Edinensis, 1824, by R. K. Greville.
Carr. Brit. Hep. . .	British Hepaticæ, 1874–1876, by B. Carrington.
Spruce on Ceph. .	On Cephalozia, 1882, by R. Spruce.
Pears. Hep. Brit. .	Hepaticæ of the British Isles, 1900–1902, by W. H. Pearson.

ABBREVIATIONS

alt.	altitude.
exs.	exserted.
per.	with perianths.
cfr.	with fruit.
C.	common.
R.C.	rather common.
V.C.	very common.
L.C.	locally common.
U.	uncommon.
F.	frequent.
R.	rare.
V.R.	very rare.
cf.	confer—that I have not seen the specimen quoted.

DISTRIBUTION OF THE SPECIES

MARCHANTIALES

RICCIACEÆ

RICCIA L.

Riccia glauca *L.*

Widely distributed from Dumfries to South Perth and West Inverness, but rare and only found in small quantity. It appears to be rather more frequent on the east side of the country than on the west, and in the latter district it usually occurs as the var. *minor* Lindenb. It does not extend as far north as does *R. sorocarpa*. The most common habitat for this plant is bare cultivated ground in moist retentive soil, but it is also found on banks and at the sides of reservoirs. Fruit is generally present from September to November. In Scotland, the species of this genus seldom survive to the middle of winter.

This species has been much confused with others until recent years. What was considered to be *R. glauca* or sometimes *R. crystallina* was generally the more common *R. sorocarpa*. The older records of the present species are on this account of little value unless specimens are available for examination.

S.W. Lowlands. — *Dumfries:* Garden path, Moffat (Johns.). *Kirkcudbright:* Field, New Galloway (M'And.).

N.W. Lowlands.—*Renfrew:* Lochwinnoch (Ewing).

E. Lowlands.—*Peebles:* North Esk Reservoir, alt. 1150 ft. (Evans). *Edinburgh:* Thriepmuir Reservoir (Evans); Rosebery Reservoir (Evans); Harlaw Reservoir (Evans). *Linlithgow:* S. Queensferry, stubble field (Evans); nr. Baads (Ewing).

S.E. Highlands.—*Fife and Kinross:* East of Aberdour, on bank, with *R. sorocarpa* (Evans). *E. Stirling:* Bannockburn (M'And.). *S. Perth:* Doune, 1883 (Ewing).

W. Highlands.—*W. Inverness:* Moidart, f. (Macv.).

Riccia sorocarpa *Bisch.*

Widely distributed from Dumfries to the northern part of East Inverness, the Inner Hebrides and West Inverness. As in the case of *R. glauca*, this species is seldom seen in summer, and its distribution is thus imperfectly known, except in the districts where there are resident botanists. In several of these districts the present plant has been found to be frequent, and it is probably generally distributed over the country where the soil is retentive, except in the North Highlands. In common with the other species of the genus, it prefers the drier climate of the south and east to that of the West Highlands, though it has been found locally common in the latter province. It becomes uncommon in the northern part of the East Highlands, and has not been found in the North Highlands, but it may be expected to occur in the lower division of that province. It has not been met with in the well-searched county of Caithness.

This species grows on moist retentive soil in fallow fields and very commonly at the side of potato fields, in gardens, footpaths, and on banks and old walls. Fruit is nearly always present from September to March, and it has also been found mature in June. As with the preceding species, the plant is most common in autumn and mostly disappears in the colder months, but may come into evidence again in early spring. In common also with that species, it does not appear to have a marked preference for any particular geological formation.

S.W. Lowlands.—*Dumfries:* Garden path, Moffat, with *R. glauca* (Johns.); cultivated field, Woodend, Moffat (Johns.). *Kirkcudbright:* Field, New Galloway, cfr. (M'And.).

N.W. Lowlands.—*Lanark:* Uddingston, garden, cfr. (Ewing).

E. Lowlands.—*Peebles:* Portmore Loch (Evans); North

Esk Reservoir (Evans); Crook, cfr. (Macv.). *Roxburgh:* Kelso, in field, cfr. (Scott). *Haddington:* St Germains, cult. field (Evans). *Edinburgh:* Near Edinburgh, cfr. (Grev.); Corstorphine Hill, on damp ground in old quarry, 1902 (Evans); King's Park, Edin. (Evans); Cramond Bridge, on path, cfr. (Evans); Torduff Reservoir (Evans); Thriepmuir Reservoir, cfr. (Evans); Loganlee Reservoir (Evans); Clubbiedean Reservoir, cfr. (M'And.); Gladhouse Reservoir, cfr. (Evans); Harperrig Reservoir (Evans); Rosebery Reservoir (Evans); N. Esk Reservoir, alt. 1150 ft. (Evans). *Linlithgow:* S. Queensferry, cult. field, cfr. (Evans); Dalmeny, shore (Evans).

S.E. Highlands.—*Fife and Kinross:* West of Aberdour, on earthy bank, cfr. (Evans); on bare soil east of Aberdour (Evans); cult. field nr. Mawcarse, Kinross-shire, cfr. (Evans); Falkland, stubble field (Evans); Leslie, old wall (Young). *Mid Perth:* Finlarig House, on turf wall (Young); do., cfr. (D. A. Haggart); garden, cfr., Tibbermore (Meld.); stubble field, Tibbermore (Meld.). *N. Perth:* Nr. Dunkeld, cfr. (M'In.); Glen Beg, Glen Shee (Ewing and Young).

N.E. Highlands. — *E. Inverness:* Nairn, cult. field (Miss Macv.); Carr Bridge, field (Miss Macv.).

W. Highlands. — *Kintyre:* Campbeltown (Ewing). *Dumbarton:* Nr. Balloch (Ewing). *W. Inverness:* Cult. fields, garden beds and paths, and bare rocks, Moidart, cfr. (Macv.).

Riccia bifurca *Hoffm.*

This is the only *Riccia* which has been found with us above the subalpine region. M'Andrew gave this species in his list of Kirkcudbrightshire hepatics, but it was subsequently ascertained that the plant was *R. Lescuriana*. It has also been recorded from the head of Glen Dole, Forfar, but no specimen has been available for examination, and it is advisable that the plant be re-examined. In Mid Perth this species grows on moist, tenacious detritus.

S.E. Highlands.—*Mid Perth:* Craig-an-Lochain, Killin, on moist gravelly soil, 1800–2000 ft. alt. (Macv.); neighbourhood of Crianlarich (Ben Challum ?), 1871 (Barker).

Riccia Lescuriana *Aust.*
R. glaucescens Carr.

This is a rare species in Scotland, and is almost confined to the south and east of the country. It has been found more frequently in the East Lowlands than elsewhere, and has not been found in the West Highlands to the north of the Clyde area. The few localities at present known for the plant hardly give much information as to the geological formation which it prefers, further than a preference for the Carboniferous area in which limestone occurs. It has been found on rocks, sides of reservoirs, and on a sand-dune. Fruit is common, and is mature from July to November.

S.W. Lowlands.—*Kirkcudbright:* East of Cairn Edward, New Galloway (M'And.). *Wigtown:* Nr. Portpatrick (M'And.).

N.W. Lowlands.—*Renfrew:* Castle Semple Loch, cfr., 1887 (Ewing).

E. Lowlands.—*Haddington:* Gullane Links (M'And.). *Edinburgh:* Clubbiedean Reservoir, cfr. (Evans); do. (M'And.); Thriepmuir Reservoir (Evans); Harperrig Reservoir (Evans). *Linlithgow:* Dalmeny, nr. sea-shore, cfr. (M'And.).

S.E. Highlands.—*Fife and Kinross:* Tents Muir, cfr. (G. West and Miss Ogilvie).

Mid E. Highlands.—*Forfar:* Sidlaw Hills (J. Aimer); Loch Long, Newtyle, cfr. (G. West).

W. Highlands.—*Dumbarton*: Loch Humphrey (Ewing and West).

Riccia crystallina *L.*

Very rare, and confined to the eastern side of the country south of the Tay. Forms rosettes on mud at the sides of ponds and reservoirs. Fruit has been found mature from August to September.

E. Lowlands.—*Edinburgh:* Glencorse Reservoir, 1905 (M'And.); do. (Evans); Torduff Reservoir (Evans); Clubbiedean Reservoir (Evans); Loganlee Reservoir (Evans).

S.E. Highlands.—*Fife and Kinross:* Edge of pond, Tents Muir, cfr. (Aimer); Burntisland Reservoir (Evans).

Riccia fluitans *L.*

Ricciella fluitans Braun

The distribution of this species is very similar to that of the preceding, being confined to the east side of the country south of the Tay. It also occurs in the same kind of habitat, as the only form which has been found in Scotland is the terrestrial plant *R. canaliculata* Hoffm. Neither of these species is met with except after prolonged drought, when the water of the ponds and reservoirs has receded below its usual level. Both might be expected to be found in Forfarshire. Fruit has been found on the present plant in September.

E. Lowlands.—*Edinburgh:* Thriepmuir Reservoir, 1905 (Evans); Harlaw Reservoir, cfr. (Evans).

S.E. Highlands.—*Fife and Kinross:* Tents Muir, 1864 (How.). *S. Perth:* Edge of pond, Shaw Park, Alloa, 1847 (Grev. Herb.).

MARCHANTIACEÆ

TARGIONIA L.

Targionia hypophylla *L.*

This Southern species is very rare, and has been found only in a few widely scattered localities. It has not been met with in the northern half of the mainland. It is confined to warm dry rocks, being most commonly on basalt, but occasionally also on conglomerate. Capsules are nearly always present. Carmichael, who discovered the Appin plant, was the well-known correspondent of Hooker; the label on his specimen is not dated.

S.E. Highlands.—*Fife and Kinross:* Nr. Raith, on basalt (Young); Scotscraig Den, on basalt (Aimer). *E. Stirling:* Nr. Stirling, 1844 (Grev. Herb.). *S. Perth:* East side of Menstrie Glen, cfr. (Croall); on both sides of Menstrie Glen, on conglomerate rocks, cfr. (Evans).

W. Highlands.—*Kintyre:* Nr. Tarbert (Lightf. *cf.* Fl. Scot., p. 792): *Argyll:* Appin, cfr. (Carmichael in Ed. Herb.).

Inner Hebrides.—*N. Inner Hebrides:* Storr Rock, Skye (Ewing).

REBOULIA Raddi

Reboulia hemisphærica (*L.*) *Raddi*

Widely distributed from Kirkcudbright to Caithness, but is rare. It does not appear to have any special distribution in Scotland. It usually is found on basaltic rocks or on old limestone walls, though it occurs also on schist and gneiss. It is to be expected that this Southern species of warm and rather dry rocks should be more frequent in the south and east of the country than in the west, and this may be found to be the case. In the meantime, with its very local distribution, too few localities are known to be certain of this. The patches which the plant forms are sometimes of considerable extent, though most frequently they are only a few inches in diameter. Fruit, which is mature from June to September, is common.

This species is sometimes classed among the mesophytes, but in Scotland it is distinctly a xerophyte.

S.W. Lowlands.—*Kirkcudbright:* Grenman, Dalry, cfr. (M'And.); Kenmure Castle, cfr. (M'And.).

N.W. Lowlands.—*Ayr:* Largs (Ewing).

E. Lowlands.—*Roxburgh:* Kelso (Scott). *Edinburgh:* Craiglockhart, cfr., 1822 (Grev.); Pentland Hills above Colinton (Evans).

S.E. Highlands.—*Fife and Kinross:* Nr. Aberdour (Evans). *S. Perth:* Menstrie Glen, on conglomerate rocks (Evans). *Mid Perth:* Limestone wall nr. Killin (Macv.).

Mid E. Highlands.—*Forfar:* Reeky Linn (J. Aimer).

W. Highlands.—*Clyde Isles:* Loch Ranza, f. and cfr. (Macv.). *W. Inverness:* Moidart, cfr. (Macv.).

Inner Hebrides.—*Mid Inner Hebrides:* Coll (Macv.). *N. Inner Hebrides:* Storr Rock, Skye, cfr. (Ewing).

Lower N. Highlands.—*W. Ross:* Attadale (Macv.).

Upper N. Highlands.—*Caithness:* Dorrery Hill, cfr. (Lillie).

CONOCEPHALUM Neck.

Conocephalum conicum (*L.*) *Dum.*

Fegatella conica Corda

A common and generally distributed species over nearly the whole of the country. It is rare or absent only in those districts where the rock seldom appears on the surface. This is especially marked in the Lowlands, where it is otherwise one of the few generally common species, but is rare in the Upper Clyde district, where rock is seldom seen, and uncommon in the Upper Tweed district, where rock is more frequent but still the exception. It is common in the Highlands and Hebrides, but uncommon in Shetland. Taking into consideration the poverty of hepatics in the Lowlands as compared with the Highlands, this species is comparatively more common in the former than in the latter. It is mostly confined to the low ground, being rare on the hills, but it ascends to 3200 ft. alt. in Perthshire. It grows on wet rocks, usually shady, and often forms large masses.

Fruit, which matures in April, is uncommon, and is especially so in the Highlands.

S.W. Lowlands.—*Dumfries:* Moffat (Johns.); Sanquhar district, R.C. (Macv.); Crichope Linn, F. (Macv.). *Kirkcudbright:* Lincluden, 1840 (Gray); New Galloway (M'And.); Penkill Burn (Macv.); Creetown (Macv.). *Wigtown:* Loch Ryan (Ewing); Dunsky Glen, v.c. (Macv.); Cairnryan (Macv.); Glenluce (Macv.); nr. New Luce (Ewing).

N.W. Lowlands.—*Ayr:* Largs, cfr. (Ewing); Mauchline, cfr. (Scott). *Renfrew:* Cloch (Ewing and West); Glen, Misty Law (Scott). *Lanark:* Hamilton Wood (Hopk. *cf.* Fl. Glott., p. 141); Bothwell Bridge, cfr. (J. Murr.); Cartland Crags, R.C. (Macv.); Tinto, alt. 1300 ft., R. (Macv.).

E. Lowlands.—*Peebles:* Cowie's Linn (Evans); Carton Burn, R. (Macv.); Logan Water nr. Kingledores, F. (Macv.); Tweedsmuir, F. (Macv.). *Selkirk:* Crossleugh Burn (Evans); Caddon Water (Macv.); Lindean (Macv.). *Roxburgh:* Fernieherst (Miss Macv.); Melrose, in deans, R.C. (Macv.). *Berwick:* Pease Dean, F. (Macv.). *Haddington:* Douglas Dean, cfr. (Evans); Haddington (Evans). *Edinburgh:*

Braid Hermitage (Grev.); banks of Water of Leith, cfr. (Grev.); Dalkeith, cfr., 1847 (Ed. Herb.); Roslin, cfr. (Ed. Herb.); do. (Evans); Habbie's Howe, cfr., 1869 (Evans); Penicuik Wood, cfr. (Evans); nr. Gorebridge (Evans). *Linlithgow:* Carriber Glen, cfr. (Evans); nr. Bathgate (Evans); Dalmeny (Evans).

S.E. Highlands.—*Fife and Kinross:* Tents Muir sands, in shallow pools dried up in summer (How.); Lomond Hills (Young); Glen Queich (Evans); Isle of May (Evans); St Andrews (Macv.). *E. Stirling:* Causewayend nr. Manuel (Evans). *S. Perth:* Strathyre (Macv.); Aberfoyle (Evans); Glen Findlas (West); Trossachs, cfr. (Ewing); Tillicoultry Glen (Evans). *Mid Perth:* Finlarig (Lightf. *cf.* Flor. Scot., p. 797); Killin, c., ascending to 3200 ft. on Ben Lawers (Macv.); Tyndrum, c. (Macv.); Loch Dochart (Macv.). *N. Perth:* Dunkeld (M'In.).

Mid E. Highlands.—*Forfar:* The Burn, Forfar, cfr., 1862 (Croall); Gannochy (Ferg.); Noran Falls (Ferg.); Reeky Linn, cfr. (Aimer). *Kincardine:* Den of Garol (Sim); Cove Bay (J. M. Hector).

N.E. Highlands.—*Elgin:* Dreggie Burn (Miss Macv.). *E. Inverness:* Cawdor, Nairn, 1859 (Croall).

W. Highlands.—*Kintyre:* Campbeltown (Ewing); Southend (Ewing); Ronachan (Macrae). *Clyde Isles:* Goatfell (Campb.); Corrie, Arran (Ewing); L. Ranza, c. (Macv.); Kyles of Bute (Ewing). *Dumbarton:* Ardlui (Macv.); Arrochar, c. (Macv.); Tarbert (Macv.). *W. Stirling:* Inversnaid (Macv.). *Argyll:* Loch Awe district, r.c. on the low ground (Macv.); Glen Nant, f. (Macv.); head of Loch Long (Macv.); Kentallen (Macv.); Ben Arthur, alt. 400 ft. (Macv.). *W. Inverness:* Moidart, c. (Macv.); Sunart (Macv.); Ardnamurchan, c. (Macv.); Fort William (Macv.); Glen Nevis (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Islay, several places, as Texa, Ardbeg, Port Ellen Lighthouse, Ardtalla Glen (Gilm.); Machrie (Miss Evans). *Mid Inner Hebrides:* Tobermory (Kenn.); do., c. (Macv.). *N. Inner Hebrides:* Broadford district, Skye, f. (Macv.); Canna (Macv.); Portree (Ewing).

Outer Hebrides.—Tarbert, Harris (West); Balallan, Lewis (West).

Lower N. Highlands.—*W. Ross:* Strome Ferry, c. (Macv.); Strathcarron, c. (Macv.); Gairloch (Miss Macv.). *E. Ross:* Fortrose (Miss Macv.); Fairy Glen, Rosemarkie (Miss Macv.).

Upper N. Highlands.—*E. Sutherland:* West Helmsdale (Lillie). *W. Sutherland:* Strath Halladale (Lillie); Smoo Cave, Durness (Lillie). *Caithness:* Reisgill Burn (Lillie); Dorrery Hills (Lillie).

Orkney.—Hoy (West).

Shetland.—Loch of Cliff and Saxavord, Unst (Lillie); Pettawater Burn, Weisdale (Beeby).

LUNULARIA Adans.

Lunularia cruciata (*L.*) *Dum.*

In the East Lowlands this species is widely distributed in gardens, and when these gardens are situated close to a ravine, *Lunularia* spreads into this ravine and frequently occurs in abundance, becoming naturalised among the other vegetation; so much so, that those who do not know the history of the species invariably consider it to be a native. If a garden is not at the present time close to such ravine, the evidence of former habitations is to be found. On the other hand, it has not been found in any of the ravines remote from present or past habitations. In the West Lowlands the species has only been found near gardens and houses and adjoining waste places, with the exception of one locality where a specimen was found "about a mile from houses." The naturalisation of alien Southern plants in the east and not in the west of Scotland occurs also in the case of phanerogams. Its distribution near the coast in the East Highlands is not well known. It appears to be rare, as, among the numerous hepatics which I have seen from that district, *Lunularia* has only been sent to me on two occasions, both of the localities being near habitations. In the central districts of this province the species is rare and has also been found only in or near gardens and waste places. In the West Highlands it is very rare and has only been found in or alongside gardens near houses. The only locality in which I have seen it in West Inverness is in a greenhouse, in flower-pots with ferns

brought from Cambridgeshire, so that it cannot be considered established here. From the northern counties I have seen only one specimen. This was from Caithness, where it was found in a garden close to some ferns "brought from England a few years ago."

Whether the species will spread out of gardens to any extent on the west side of Scotland is doubtful, but that it will extend its range in the east is probable.

Lunularia is not mentioned by the earlier Scottish botanists, nor are there any specimens of it in the Edinburgh Herbarium, except one of Taylor's from Dunkerron, Ireland, dated 1844. That most accurate botanist Greville does not mention it in his *Flora Edinensis*, 1824. He gives *Marchantia* as "plentiful," which would at the present time apply rather to *Lunularia*. At the same time he mentions other species as *Frullania Tamarisci* being "plentiful" and *F. dilatata* "extremely common"—the former being now rare near Edinburgh, the latter uncommon. This doubtless is mainly due in the case of *Frullania* to the increased impurity of the air around the town. I do not know if *Marchantia* is affected in this way, but it is probable that Greville did not see enough of *Lunularia* to gain much knowledge of it, and has taken *Marchantia* to be the same species. He could hardly make this mistake at the present time, as *Lunularia* occurs in profusion in most of the ravines near Edinburgh, and its unmistakable lunulate gemmiferous receptacles are nearly always in evidence.

S.W. Lowlands. — *Dumfries:* Craigieburn garden, nr. Moffat (Johns.): Hydropathic garden, Moffat (Johns.). *Kirkcudbright:* Bank at outside of Kenmure Castle garden (M'And.).

N.W. Lowlands. — *Ayr:* Fairlie Glen, about a mile above dwelling-houses (Ewing). *Renfrew:* Cloch (Ewing and West); base of wall, 100 yds. from Lochwinnoch village (Scott). *Lanark:* Uddingston, roadside (Ewing).

E. Lowlands.—*Selkirk:* Faldonside garden (W. B. Boyd); Clovenfords, Thomson's Vineyards, and ½ mile below there in Caddon Water (Macv.). *Roxburgh:* Field nr. Kelso, c. (Scott); Melrose Abbey (Macv.). *Berwick:* Longformacus

(Miss Macv.); Cockburnspath (M'And.); Dryburgh Abbey (Macv.). *Haddington:* Douglas Dean, v.c. (Evans); Haddington (Evans). *Edinburgh:* Hermitage (M'And.); nr. Gorebridge (Evans); Bilston Burn (Evans); Rosslyn Woods, on rocks by riverside (Evans); Bonally Tower (M'And.); Colinton Dell, in plenty (M'And.); Dalkeith Park (Evans). *Linlithgow:* Carriber Glen (Evans); by side of Almond river, Dalmeny (Evans); Dalmeny Wood (M'And.).

S.E. Highlands.—*Fife and Kinross:* Footpath, Raith (Young). *E. Stirling:* Causewayend nr. Manuel (Evans). *S. Perth:* Banks of the Teith nr. Doune (K. & S.). *Mid Perth:* Methven Wood on rubbish-heap (Meld.). *N. Perth:* Nr. Coupar-Angus (W. M. Scott).

Mid E. Highlands.—*Forfar:* Arbirlot, on rocks below bridge (J. Aimer). *Kincardine:* Roadside at Mill near Dunnottar (M'And.).

W. Highlands. — *Kintyre:* Tarbert (Ewing). *Clyde Isles:* Bute (Ewing). *Dumbarton:* Shandon Hydropathic (Miss P. Macv.); Manse garden wall, Arrochar (Macv.). *W. Inverness:* In a greenhouse, Moidart (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Distillery, Port Ellen, Islay (Gilm.); Kildalton grounds (Ewing).

Upper N. Highlands. — *Caithness:* Manse garden, Watten (Lillie).

PREISSIA Corda

Chomiocarpon Corda

Preissia quadrata (*Scop.*) *Nees*

P. commutata Nees

Widely distributed from Dumfries to Shetland, but frequent only in the Highlands. It is uncommon in the West Lowlands, and almost confined to the subalpine districts. It is very rare in the East Lowlands and is confined to subalpine localities, with the exception of one station in damp hollows on a sand-dune. Is uncommon in Fife and the low-lying ground of the East and North Highlands, but is frequent and sometimes common over the hilly districts of the Highlands, ascending to 3300 ft. in Perthshire. It is frequent in the West Highlands and in some of the Hebrides, especially on the lower ground. Although it is

occasionally frequent on the higher hills in the Highlands, it is more common near their bases. It occurs on various formations, but prefers limestone, where it sometimes is an abundant species. Fruit, which matures from June to September, is common. The plant on the high ground of Perthshire has usually narrower fronds than when on the low ground.

S.W. Lowlands.—*Dumfries:* Penton Linns, cfr. (Scott); Well Burn, Moffat, cfr. (M'And.); Whitecombe, cfr. (Johns.). *Kirkcudbright:* New Galloway (M'And.); House of Hill (J. Murr.); Penkill Burn, cfr. (Macv.). *Wigtown:* Knowe, cfr. (Ewing).

N.W. Lowlands.—*Ayr:* Ness Glen, cfr. (M'And.). *Renfrew:* Kittockside (T. B. Wilkie); Cloch (West); nr. Loch Thom (West); Ferguslie, cfr. (J. Taylor); Glen, Misty Law (Scott); wall between Gourock and Cloch, v.c. (Macv.).

E. Lowlands.—*Peebles:* Nr. Carlops, cfr. (Evans); Talla Water, cfr. R. (Macv.). *Selkirk:* Crossleugh Burn (Evans). *Haddington:* Gullane sandhills, on rock in damp hollow (Evans). *Edinburgh:* Bonally Burn, Oct. 1855, *sub nom. Targionia hypophylla* (John Lowe); Monks Burn, below Ninemileburn (Evans); Moorfoot Water, cfr. (Evans). *Linlithgow:* Binny Craig (M'And.).

S.E. Highlands.—*Fife and Kinross:* Lomond Hills (Young); Glen Queich (Evans); Largo Links, cfr. (M'And.). *E. Stirling:* Touch Moor, at a spring, cfr. (Croall). *S. Perth:* Trossachs (Ewing); Tillicoultry Glen, cfr. (Evans). *Mid Perth:* Killin (Lightf. *cf.* Fl. Scot., p. 796); Craig Chailleach, cfr. 1824 (Grev. Herb.); Lawers Burn, cfr. (Evans); Killin district, c. on the low ground and frequently on the hills, cfr., ascending to 3300 ft. (Macv.); Ben Heasgarnich (West); Tyndrum district, R.C. on low ground and on the hills (Macv.). *N. Perth:* Glas Tulchan (Ferg.); Glen Shee, cfr. (Ewing); Ben-y-Gloe (E. M. Holmes); Glen Thaitneich, cfr. (Ferg.).

Mid E. Highlands.—*Forfar:* Edzell, 1840 (Ed. Herb.); Sands of Barrie, 1842 (Gard.); Gannochy, cfr., 1848 (G. Lawson in Ed. Herb.); Den of Airlie (Ferg.); Denven Glen (J. Aimer); Newtyle (G. West); Glen Isla (G. West). *Kincardine:* Den of Garol (Sim). *S. Aberdeen:* Carr

Rocks, Castleton, cfr., 1867 (Dickie); Corrie Mulzie (Stabl.); The Coyle, Abergeldie, cfr. (Stabl.).

N.E. Highlands.—*E. Inverness:* Carn Dearg, Aviemore, alt. 1400 ft. (Macv.).

W. Highlands.—*Kintyre:* Tarbert (Ewing). *Clyde Isles:* Loch Ranza, R. (Macv.). *Dumbarton:* Inverarnan, (Lightf. *cf.* Fl. Scot., p. 796); Ardlui, cfr. (Macv.); Arrochar, v.c. (Macv.). *Argyll:* Pass of Melfort, 1886 (Holmes); Glencoe (Macv.); Glen Nant, cfr. F. (Macv.); Loch Awe, F. on the low ground, U. on the hills (Macv.); Ben Doireann, cfr. (Macv.); Kentallen (Macv.). *W. Inverness:* Moidart, cfr. F. (Macv.); Ardnamurchan, cfr. F. (Macv.); Sunart, cfr. F. (Macv.); Fort William (Macv.); Glen Nevis (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Ardtalla Glen, Islay (Gilm.). *Mid Inner Hebrides:* Coll (Macv.); Tobermory, F. (Kenn.). *N. Inner Hebrides:* Ben Cailleach (Lightf. *cf.* Fl. Scot., p. 796): do., alt. 400 ft. (Macv.); Mill Burn, Broadford, v.c. cfr. (Macv.); Sligachan, cfr. (Miss Macv.).

Outer Hebrides.—Harris, cfr. (Ewing).

Lower N. Highlands.—*W. Ross:* Strome Ferry, F. cfr. (Macv.); Strathcarron (Macv.); Gairloch, cfr. (Miss Macv.).

Upper N. Highlands.—*E. Sutherland:* Nr. Rogart (Lillie). *Caithness:* Reisgill Burn (Lillie).

Shetland.—Kergord Burn, Weisdale (Beeby).

MARCHANTIA L.

Marchantia polymorpha *L.*

An uncommon plant in Scotland, though found from Dumfries to Shetland. Is more frequent on the east than on the west side of the country. Is rare in the West Lowlands, and uncommon in the south-east counties. Uncommon in the cultivated regions of the East Highlands and rare in the hilly districts. Is very rare in the West Highlands and Hebrides, also in the North Highlands. It is found on damp walls on the outskirts of villages, in gardens and on waste-heaps. These are doubtless its usual centres of distribution, and in such cases it cannot be con-

sidered as indigenous. It occurs as a native in marshy ground, at the side of streams; and in moist ground among boulders on some of the hills of the Eastern Highlands. Its most frequent locality in the Lowlands, remote from houses, is at the side of streams in the subalpine region, or less frequently in glens running through the cultivated districts. It ascends to 3200 ft. alt. in Perthshire. Mature fruit is very rare, but gemmæ are almost always present.

S.W. Lowlands. — *Dumfries:* Penton Linn (Scott); Kirkconnel Mill (Macv.). *Kirkcudbright:* New Galloway (M'And.).

N.W. Lowlands.—*Ayr:* Darvel (Ewing). *Lanark:* Uddingston, cfr. (Ewing); Glen Elvan, on rubbish-heap at side of railway (Macv.); Allershaws and Evan Waters, on rocks at side of the streams, R.C. (Macv.).

E. Lowlands — *Peebles:* Carlops (Evans); Medwyn Water, cfr. (Evans); Logan Water, alt. 1050–1200 ft. (Macv.). *Roxburgh:* Kelso, on damp, shady stones (Scott); do., C. on damp wall (Macv.); Fairy Dean, Melrose, at side of stream (Macv.); wall at outskirts of Melrose (Macv.). *Berwick:* Longformacus (Miss Macv.); Cockburnspath (M'And.); nr. Seenes Law, side of stream (Evans); Dryburgh Abbey (Macv.). *Haddington:* Luffness Links (Evans); St Germains, cult. field (Evans); Gullane sands (M'And.). *Edinburgh:* In septo regis Edinbergensi (Sibb. *cf.* Scot. Ill. part. sec., p. 59, 1684); Edinburgh Park (Mr Yalden *cf.* Lightf. Fl. Scot., p. 1148); Pentland Hills, 1848, cfr. (Ed. Herb.); nr. Edinburgh (Grev.); nr. Currie (Evans); damp wall by roadside, Balerno (Macv.); Bilston Glen, cfr. (Evans); Torduff Reservoir (Evans). *Linlithgow:* Railway side nr. Kirkliston, cfr. (Evans); above Carriber on stones by the Avon (Evans).

S.E. Highlands.—*Fife and Kinross:* Kenly Den, cfr. (How.); Cullalo (Evans). *S. Perth:* Shaw Park, Alloa, cfr. 1847 (Grev. Herb.); Benclcuch, in springs (Evans). *Mid Perth:* Ben Lawers, on wet ground among boulders, alt. 3200 ft., cfr. (Macv.). *N. Perth:* Tummel valley, Pitlochry, cfr. (E. M. Holmes).

N.E. Highlands.—*Forfar:* Bog of Restenet, cfr. 1836 (Grev. Herb.); nr. Montrose, 1847, cfr. (Herb. Cruicks.);

the Burn, foot of Glenesk (Croall); Reeky Linn (Aimer). *Kincardine:* Inchmarlo, v.c. (J. C. Fordyce). *S. Aberdeen:* Lochnagar, 1847 (Balfour); Braemar (Croall); nr. Balmoral Castle on burnt wood, cfr. (J. Michie); Skene, cfr. (Dickie).

W. Highlands.—*Clyde Isles:* Rothesay (M'And. *in litt.*). *Dumbarton:* Milngavie, cfr. (J. Murr.). *W. Stirling:* Campsie, cfr. (Ewing); banks of canal nr. Kilsyth (K. & S.). *W. Inverness:* Moidart, in a marsh, also at foot of damp wall, and garden, r. (Macv.).

Inner Hebrides.—*Mid Inner Hebrides:* Tobermory Distillery, on walls (Macv.).

Outer Hebrides.—Edge of loch, Balallan, Lewis (West).

Lower N. Highlands.—*E. Ross:* Fairy Glen, Rosemarkie (Miss Macv.).

Upper N. Highlands.—*Caithness:* Achmachy, Dunbeath (Lillie).

Shetland.—Whalsey, beside loch (Lillie).

JUNGERMANNIALES

JUNGERMANNIACEÆ ANACROGYNÆ

ANEURA Dum.

Riccardia S. F. Gray

Aneura pinguis (*L.*) *Dum.*

Generally distributed over the whole of the country from Dumfries to Shetland. In the cultivated districts of the Lowlands it is uncommon, and occasionally even in the subalpine region, as in the Upper Clyde district; but it is usually a frequent species in the subalpine regions and is sometimes common. It is common over all the Highlands and in the Islands, both on the low ground and on the hills, and ascends to 3300 ft. alt. in Perthshire. Occurs on all formations, and is sometimes especially abundant on limestone rocks. Is found in ditches, marshes, side of streams, peat-mosses, wet rocks, and on moss tufts in wet places.

Fruit, which is mature from April to August, is frequent.

S.W. Lowlands.—*Dumfries:* Moffat (M'And.); Euchan Water, f. (Macv.). *Kirkcudbright:* Blackcraig, etc., New Galloway (M'And.); Glen Trool (Macv.); Creetown (Macv.). *Wigtown:* Knowe (Ewing); Stranraer (Macv.).

N.W. Lowlands.—*Ayr:* Largs (Ewing); Glen Afton (Macv.). *Renfrew:* Cloch, cfr. (Ewing and West); Misty Law (Scott). *Lanark:* Cartland Crags (Ewing); Bonnington Falls, cfr. (Young); Tinto, cfr. (Macv.); Elvanfoot district, u. (Macv.); Green Lowther, alt. 1700 ft., r. (Macv.).

E. Lowlands.—*Peebles:* Cowie's Linn, cfr. (A. Murr.); Carlops, cfr. (Evans); Carton Burn, alt. 800–1200 ft., r.c. (Macv.); Logan Water, r.c. (Macv.); Tweedsmuir, cfr. c. (Macv.). *Selkirk:* Crosselengh Burn (Evans). *Roxburgh:*

Kelso (Scott); Melrose district, R. (Macv.). *Berwick:* Crib Law, Lammermuir Hills (Evans); Cockburnspath, F. (M'And.). *Haddington:* Oldhamstocks, cfr. (Evans); Dunglass (M'And.); Gullane Links, cfr. (M'And.). *Edinburgh:* Roslin Woods, cfr. (Grev.); Allermuir Glen, cfr. (Evans); Ravelrig, cfr. (Evans); Braid Hermitage (Evans); Clubbiedean (Evans); Nether Habbie's Howe (Evans); nr. Swanston, cfr. (Evans). *Linlithgow:* Drumshoreland (Evans); nr. S. Queensferry (M'And.); Dalmeny (Evans).

S.E. HIGHLANDS.—*Fife and Kinross:* Glassmount (Grev. *cf.* Fl. Edin., p. 270); Lomond Hills, cfr. (Young); N. Queensferry (M'And.); Glen Queich (Evans); St Andrews (Macv.). *S. Perth:* Strathyre (Macv.); Aberfoyle (Evans); Trossachs (Ewing and West). *Mid Perth:* Killin district, C. both on low ground and on the hills to 3300 ft. (Macv.); Tyndrum district, C. (Macv.); Ben Heasgarnich (Ewing); Coire Ardran (Macv.); Craig Vinean, cfr. (M'In.). *N. Perth:* Glen Beg, Glen Shee (Ferg.); Glen Sochaidh (West); Glen Tilt (West); Ben Gulabin, cfr. (Ew. and Young).

MID E. HIGHLANDS.—*Forfar:* Clova (Ferg.); Fern (Ferg.); Sidlaws (Aimer); Reeky Linn (Aimer). *Kincardine:* Kerloch (Sim). *S. Aberdeen:* Glen Candlie, 1845 (Gard.); Potarch (Sim); Braemar (Stabl.); Linn of Quoich (Holmes); Coire Ceanmor (Ew. and Young). *N. Aberdeen:* Mormond Hill (Ewing).

N.E. HIGHLANDS.—*Elgin:* Dreggie Burn (Miss Macv.). *E. Inverness:* Aviemore (Macv.); Loch Vaa (Macv.); Slochd (Miss Macv.); Carr Bridge (Miss Macv.); Kincraig, cfr. (Miss Macv.); Braeriach (J. A. Wheldon); Fort Augustus (Macv.).

W. HIGHLANDS.—By Loch Long, 1857 (Grev. Herb.). *Kintyre:* Campbeltown (Ewing); Lochgilphead (Ewing). *Clyde Isles:* Loch Ranza, C. (Macv.). *Dumbarton:* Ardlui, F. (Macv.); Arrochar, C. (Macv.). *W. Stirling:* Campsie (Ewing); Inversnaid (Macv.). *Argyll:* Sandbank (Ewing); Loch Awe district, C. on low ground and on the hills (Macv.); Glen Nant, C. (Macv.); Ben Udlaidh nr. Tyndrum (Macv.); Loch Tulla, C. (Macv.); Lochan Bhe, C. (Macv.); Ben Doureann (Macv.); Kentallen (Macv.); Ballachulish (Macv.); Glencoe (West). *W. Inverness:* Moidart, C. cfr.,

F. (Macv.); Ardnamurchan, C. (Macv.); Sunart, C. (Macv.); Glen Nevis, C. (Macv.); Ben Nevis (Macv.).

INNER HEBRIDES.—*S. Inner Hebrides:* Jura (Ewing). *Mid Inner Hebrides:* Tobermory (Kenn.); Misnish Loch (Macv.); Salen (Kenn.). *N. Inner Hebrides:* Broadford district, V.C. (Macv.); Sligachan (Miss Macv.).

OUTER HEBRIDES.—Tarbert, C. (West); Balallan, C. (West); Stornoway (Gibs.).

LOWER N. HIGHLANDS.—*W. Ross:* Strathcarron, C. (Macv.); Strome Ferry, V.C. (Macv.); Gairloch (Miss Macv.). *E. Ross:* Achnasheen, R.C. (Macv.); Loch Luichart (West); Falls of Rogie (M'In.).

UPPER N. HIGHLANDS.—*E. Sutherland:* Ben Griam Mohr (Lillie); West Helmsdale (Lillie). *W. Sutherland:* Strath Halladale, cfr. (Lillie); Ben Clibreck (Lillie); Smoo Cave (Lillie). *Caithness:* Watten (Lillie); Lybster (Lillie).

ORKNEY.—Hoy, C. (West); Finstown (West); Kirkwall (West).

SHETLAND.—Gelli Gill nr. Hillswick (Beeby); Lerwick (West); Scalloway, several places (West); Tresta (Beeby).

ANEURA INCURVATA (*Lindb.*) *Steph.*

Found only as yet in one locality in the East Lowlands, in wet ground near the coast.

E. LOWLANDS.—*Berwick:* Pease Dean, cfr., 1901 (Macv.).

ANEURA MULTIFIDA (*L.*) *Dum.*

Uncommon on the low-lying parts of the Lowlands and East Highlands, but sometimes frequent in the subalpine regions. It is a less common plant than *A. pinguis*, especially in the Lowlands. Is uncommon in the Upper Clyde district, but frequent in that of the Upper Tweed. It is common in the subalpine parts of the East Highlands and ascends to 3200 ft. alt. in North Perth. Is frequently very common in the West Highlands and Islands and is common in the North Highlands and Shetland. It occurs on various formations and is found in marshes, especially when peaty, also by the side of streams and on wet rocks in ravines.

Fruit is mature from April to July, but is uncommon.

S.W. Lowlands.—*Dumfries:* Brownhall, 1840 (Cruicks.); Moffat (Miss Macv.); Crawick Water, r. (Macv.). *Kirkcudbright:* New Galloway (M'And.); Glen Trool (Macv.). *Wigtown:* Cairnryan (Macv.); Glenluce (Macv.).

N.W. Lowlands.—*Ayr:* Barskimming Moor (Scott). *Renfrew:* Cloch (West). *Lanark:* Bothwell Woods (Hopk. *cf.* Fl. Glott., p. 140); Holland Bush, Hamilton (J. Murr.); Tinto (Macv.); Elvanfoot district, u. (Macv.); Green Lowther to 1700 ft., r. (Macv.).

E. Lowlands.—*Peebles:* Carton Burn, f. (Macv.); Talla Water, f. (Macv.). *Selkirk:* Crossleugh Burn (Evans); Clovenfords, cfr. (Macv.). *Roxburgh:* Melrose district, r. (Macv.). *Berwick:* Cockburnspath (M'And.). *Haddington:* Newlands nr. Gifford (Evans); Gullane Links, cfr. (M'And.); Gosford (M'And.). *Edinburgh:* Corstorphine Hill, Roslin and Auchendinny Woods (Grev. *cf.* Fl. Edin., p. 271); nr. Edinburgh, cfr. (Grev.); Inveresk (Evans); Swanston (Evans); Balerno (M'And.). *Linlithgow:* Nr. Bathgate (Evans); Carriber (Evans); Dalmeny (Evans).

S.E. Highlands.—*Fife and Kinross:* Glassmount (Grev. *cf.* Fl. Edin., p. 271); Burntisland (Young); West Lomond Hill (Evans). *S. Perth:* Strathyre (Macv.). *Mid Perth:* Killin district, c. ascending to 2700 ft. (Macv.); Tyndrum district, c. both on low ground and hills (Macv.); Coire Ardran (Macv.). *N. Perth:* Glas Thulachan, alt. 3200 ft. (Ferg.); Ben Gulabin (Ew. and Young).

Mid E. Highlands.—*Forfar:* Nr. Forfar, 1824 (Grev.). *Kincardine:* Linn of Dye (Sim). *S. Aberdeen:* Ben Beck, 1845 (Gard.); Potarch (Sim); Balmoral (Stabl.); Glen Beg (Stabl.); Lion's Face (Stabl.); Coire Ceannor (Ew. and Young).

N.E. Highlands.—*Elgin:* Glenbeg nr. Grantown (Miss (Macv.). *E. Inverness:* Carn Dearg, Aviemore (Macv.); Slochd (Miss Macv.); Carr Bridge (Miss Macv.).

W. Highlands.—*Clyde Isles:* Brodick (Campb.); Loch Ranza (Campb.); do., c. (Macv.). *Dumbarton:* Milngavie (Ewing); Arrochar (Macv.); Ardlui, c. (Macv.); Tarbert (Macv.). *W. Stirling:* Inversnaid (Macv.). *Argyll:* Kilmun (T. B. Wilkie); Sandbank, cfr. (Ewing); Coire Athoich, Ben More (A. Murr.); Loch Awe district, r.c. on low ground and on the hills (Macv.); Glen Nant, f. (Macv.);

Lochan Bhe, v.c. (Macv.); Ben Doureann (Macv.); Kentallen, cfr. (Macv.); L. Tulla (Macv.); Ballachulish (Macv.); Glencoe (West). *W. Inverness:* Moidart, c. (Macv.); Ardnamurchan, c. (Macv.); Sunart, c. (Macv.); Glen Nevis (Macv.); Ben Nevis (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Ardtalla, Islay (Gilm.); Kildalton Woods (Ewing). *Mid. Inner Hebrides:* L. Misnish (Macv.); Achnadrisg (Macv.); Salen (Kenn.). *N. Inner Hebrides:* Mill Burn, Broadford, v.c. (Macv.); Corrie, Broadford, u. (Macv.).

Outer Hebrides.—Benbecula (Ewing); Tarbert (West).

Lower N. Highlands.—*W. Ross:* Strome Ferry, f. (Macv.); Strathcarron, c. (Macv.). *E. Ross:* Achnasheen (Macv.); nr. Fortrose (Miss Macv.).

Upper N. Highlands.—*E. Sutherland:* West Helmsdale (Lillie); Loch Brora (Lillie). *W. Sutherland:* Strath Halladale (Lillie); Strath Naver (Lillie); Ben Clibreck (Lillie). *Caithness:* Dunnet Links (Lillie); Stemster Loch (Lillie).

Orkney.—Hoy (West); Kirkwall (West).

Shetland.—Lerwick (Sim); Scalloway, c. (West); Northmavin (Sim); Bergs of Skelberry, Northmavin, alt. *ca.* 500 ft. (Beeby); Fair Isle (Miss Skene).

Aneura latifrons *Lindb.*

Is rare in the Lowlands generally, though found in some peat-mosses and other wet ground; it is very rare in the Upper Clyde district, and has not been found in the Upper Tweed district. It is also rare in the East Highlands and Central Scotland generally. Is most frequent in the West and North Highlands, usually in peat-mosses and on peaty banks, and it has been found in several places in the Hebrides and Shetland. It occasionally is also found on decaying logs and stumps. It does not ascend the hills, but has a more northern distribution than *A. palmata.* Fruit is mature from May to July and is frequent.

S.W. Lowlands.—*Dumfries:* Gallow Hill, Moffat (M'And.). *Kirkcudbright:* New Galloway (M'And.). *Wigtown:* Side of Loch Ryan, Stranraer (M'And.); Portpatrick (M'And.); Gallow Hill, Stranraer, on a log (Macv.).

N.W. Lowlands.—*Lanark:* Tinto, alt. 900 ft. (Macv.); Elvanfoot, peat-moss, v.r. (Macv.).

E. Lowlands.—*Peebles:* Moor nr. Leadburn (Evans); Cowie's Linn (M'And.). *Roxburgh:* Kelso, cfr. (Scott). *Edinburgh:* Allermuir Glen, cfr. (Evans); Logan Burn (A. Murr.); Balerno Moss (M'And.); Auchendinny, cfr. (M'And.); nr. Cramond, on sandstone rocks (Evans). *Linlithgow:* Nr. S. Queensferry (M'And.).

S.E. Highlands.—*Fife and Kinross:* Burntisland, cfr. (Young). *Mid Perth:* Lamberkin nr. Perth (Meld.); stumps nr. Tyndrum (Macv.).

Mid E. Highlands.—*Kincardine:* Stonehaven on decaying wood (M'And.) *N. Aberdeen:* Mormond Hill (Ewing).

N.E. Highlands.—*E. Inverness:* On stump, Loch Vaa (Miss Macv.); peat-moss, Carr Bridge (Miss Macv.).

W. Highlands. — *Kintyre:* Campbeltown (Ewing). *Clyde Isles:* Peat-moss nr. Loch Ranza, c. (Macv.). *Argyll:* Peat-moss, head of Loch Awe (Macv.); L. Tulla, on stumps, r. (Macv.). *W. Inverness:* Moidart, c. on peat-mosses and peat banks, more rarely on stumps, cfr. f. (Macv.); Ardnamurchan (Macv.); Sunart (Macv.); Glen Nevis (Macv.).

Inner Hebrides.—*Mid Inner Hebrides:* L. Misnish (Macv.); L. Frisa (Macv.). *N. Inner Hebrides:* Peat-moss nr. Broadford, f. (Macv.).

Outer Hebrides.—Balallan (West).

Lower N. Highlands.—*W. Ross:* Strathcarron Moss, c. (Macv.). *E. Ross:* L. Luichart (West).

Upper N. Highlands.—*E. Sutherland:* Between Durness and Tongue (Lillie). *Caithness:* Reisken, cfr. (Lillie); Watten (Lillie); Badlipster (Lillie); West Dunnet Hill (Lillie).

Orkney.—Hoy (West).

Shetland.—Shetland (Sim); Unst (Sim); Whiteness (Sim); Burn of Vallor (Sim).

Aneura palmata (*Hedw.*) *Dum.*

Distributed from Dumfries to Shetland, but is a rare species in general. Very rare in the West Lowlands, and has not been found in the East Lowlands. Occurs locally in some quantity in several parts of the East Highlands.

Is rather rare in the West Highlands, except in a few places in West Inverness and Argyll. It has not been found in the Inner Hebrides, and is rare in the North Highlands. In the Lowlands and East Highlands it appears to be confined to decaying logs and stumps or rarely sandstone rocks. In the West Highlands it is found also on peat; in the extreme north of the mainland, the Outer Hebrides, and the northern islands it has only been found on the peat. It occurs in compact dark-green patches, generally unmixed, though occasionally with *Nowellia curvifolia* and *Scap. undrosa*. Fruit is rare, and mature from June to August.

S.W. Lowlands.—*Dumfries:* Gallow Hill, Moffat, on wood, cfr. (M'And.). *Kirkcudbright:* New Galloway, on wood (M'And.).

S.E. Highlands.—*Fife and Kinross:* Lomond Hills, on sandstone rock (Young); do., Glen Burn (Evans). *E. Stirling:* Wester Glen, Gargunnock, on old wood (K. & S.) *S. Perth:* Trossachs, on old wood, 1876 (Carr.); do. (Ewing and West). *Mid Perth:* Finlarig Wood, on old logs (Ewing); Achrioch Wood, Tyndrum, R.C. on stumps (Macv.).

Mid E. Highlands.—*Kincardine:* Mount Shade, 1873 (Sim); Scolty, on wood (Sim); nr. Stonehaven, on wood (M'And.). *S. Aberdeen:* Potarch (Sim); Craigendinny (Sim); Balmoral, on decaying wood (Stabl.); Ballochbuie, on decaying wood (Michie).

N.E. Highlands.—*Elgin:* Glen Beg nr. Grantown, on old wood (Miss Macv.). *E. Inverness:* Carr Bridge, on fir stump (Miss Macv.).

W. Highlands.—*Argyll:* Nr. Ballachulish, on logs, cfr. (Macv.); L. Tulla, on stumps, F. (Macv.); Ben Fhada, Glencoe (West); Balliveolan Burn, L. Creran (Kenn.). *W. Inverness:* Glenfinnan (Carr. *cf.* Pears. Hep. Brit., p. 450); Moidart, on logs, stumps, and on peat, F. (Macv.); Salen Burn, Ardnamurchan, on stumps (Macv.); Sunart, on logs (Macv.); Coire Dheirg, Glen Nevis, on log (Macv.).

Outer Hebrides.—Benbecula, on peat (West).

Lower N. Highlands.—*W. Ross:* Strathcarron, on log and on peat, R. (Macv.).

Upper N. Highlands.—*Caithness:* Watten, on peat (Lillie).

Orkney.—Hoy, on peat (West); Culags, Hoy, cfr. (Lillie).
Shetland.—Scalloway, on peat (West); Yell, on peat (Sim); Unst, on peat (Sim).

METZGERIA Raddi

Metzgeria furcata (*L.*) *Lindb.*

Widely distributed from Dumfries to Shetland, and generally common on the low-lying ground where there is some degree of shelter, but there are many sheltered localities where it is by no means common although the surrounding conditions appear equally favourable. In the Lowlands it is rather common in woodland districts, but becomes rare in the valleys above an altitude of 800 ft., as in the Upper Clyde and Upper Tweed districts. It is common in the East and West Highlands and Inner Hebrides, but less so in the extreme north of the mainland. It is rare on the hills and doubtfully ascends above 1800 ft. alt. It usually occurs on trees in the Lowlands, though not rare on rocks. In the Highlands it is found equally common on rocks and on trees. Although preferring some shelter, this species is frequently seen on exposed rocks, especially on the sea-shore. It grows on various formations and is sometimes common on limestone. Fruit is rare, and is mature from September to February.

S.W. Lowlands.—*Dumfries:* Brownhall nr. Dumfries 1840 (Cruicks.); Drumlanrig (J. Murr.); Moffat, c. cfr. (Johns.); Euchan Water, r. (Macv.); Crichope Linn, u. (Macv.). *Kirkcudbright:* New Galloway, cfr. (M'And.); Carsphairn (West); Creetown (Macv.); Loch Trool, c. (Macv.). *Wigtown:* Portpatrick (M'And.); Castle Kennedy (Macv.); Glen Luce (Macv.); nr. New Luce (Ewing).

N.W. Lowlands.—*Ayr:* Darvel (Ewing); Dalmellington (West); Glen Afton, r. (Macv.); Ladyland (Miss Macv.). *Renfrew:* Loch Thom (Ewing and West); Cloch (West). *Lanark:* Woodside (Hopk. *cf.* Fl. Glott., p. 140); Wabston (J. Murr.); Falls of Clyde (Ewing); Cartland Crags, f. (Macv.); Symington, r. (Macv.); Elvanfoot district, v. (Macv.).

E. Lowlands.—*Peebles:* Lamancha (Evans); Cowie's

Linn (Evans); Rachan, v.r. (Macv.). *Selkirk:* Howden (Evans); Bowhill (Evans); Caddon Water (Macv.); Glenkinnon Burn (Macv.); Lindean, c. (Macv.); Yarrow (Macv.). *Roxburgh:* Kelso, cfr. (Scott); Melrose, f. (Macv.). *Berwick:* Pease Dean (Macv.); Longformacus (Miss Macv.). *Haddington:* Dunglass Woods (Evans); Lennoxburn (Evans); Traprain Law (M'And.). *Edinburgh:* Roslin Woods, cfr. (Grev.); Hillend Wood (Evans); Craiglockhart (Evans); Craigmillar (Evans); Bonally Burn (A. Murr.); Penicuik (Evans). *Linlithgow:* Carriber Glen (Evans); Dalmeny (M'And.).

S.E. Highlands.—*Fife and Kinross:* Raith (Young); Dunearn (Young); Aberdour (Evans); Scotscraig Den (Aimer); Auchtertool (Young); St Andrews (Macv.). *E. Stirling:* Gargunnock (Kids. and Stir.); Muiravonside (Evans). *S. Perth:* Abbey Craig (Kids. and Stir.); Menstrie Glen (Evans); Wharry Glen nr. Bridge of Allan (Evans). *Mid Perth:* Foot of Ben Lawers, 1838 (Grev. Herb.); Killin, 1839 (Stark); Glen Lochy, 1839 (Ed. Herb.); Culdees Castle (Evans); Tyndrum district, u. (Macv.). *N. Perth:* Lorronty Burn (Ferg.); Dunkeld (M'In.).

Mid E. Highlands.—*Forfar:* Sidlaw Hills, 1846 (Gard.); Clova (Ferg.). *Kincardine:* Blackhall (Sim); Den of Lathers (Sim); Mount Shade (Sim); Feugh Rocks (Sim). *S. Aberdeen:* Den of Cults (Dickie); Craigendarroch (Sim); Balmoral (Stabl.). *N. Aberdeen:* Nr. Buchan (Ferg.).

N.E. Highlands.—*E. Inverness:* Nr. Aviemore (Macv.); Farr Rocks, Kincraig (Miss Macv.).

W. Highlands.—*Kintyre:* Port Righ (Ewing); Campbeltown (Ewing); Clachan (Macrae); Ronachan (Macrae). *Clyde Isles:* Bute (Ewing); Loch Ranza, v. (Macv.); Blackwaterfoot (Miss Macv.); Lamlash (M'And.); Brodick (Miss Macv.); Whiting Bay (Miss Macv.). *Dumbarton:* Dumbartonshire, 1844 (Stark); Fruim Bridge nr. Luss (J. F. Scott Elliot); Arrochar, f. (Macv.); Ardlui, f. (Macv.); Shandon (Miss Macv.); Tarbert, f. (Macv.). *W. Stirling:* Inversnaid (Kids. and Stir.); do., c. (Macv.). *Argyll:* Lismore (Macv.); Loch Awe district, u. (Macv.); Ballachulish (Macv.); Ben Doureann (Macv.); Kentallen (Macv.);

Glen Ure, Benderloch (Kenn.). *W. Inverness:* Moidart, c. (Macv.); Ardnamurchan, c. (Macv.); Sunart, c. (Macv.); Glen Nevis (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Bridge End (Gilm.); Port Ellen (Gilm.); Cairnmore Wood, Islay (Gilm.); Carrick Ford, Islay (Gilm.). *Mid Inner Hebrides:* Coll (Macv.); Tobermory (Kenn.); do., v.c. (Macv.); Dervaig (Macv.); Glenforsa (Kenn.). *N. Inner Hebrides:* Broadford district, v.c. (Macv.); Sligachan (Miss Macv.); Portree (Ewing).

Outer Hebrides.—Nr. Tarbert, Harris (West); Balallan (West).

Lower N. Highlands.—*W. Ross:* Strathcarron, u. (Macv.); Strome Ferry, u. (Macv.); Loch Maree (Miss Macv.); Gairloch (Miss Macv.).

Upper N. Highlands.—*E. Sutherland:* Nr. Brora (Lillie). *W. Sutherland:* Farr (Lillie); Smoo Cave (Lillie). *Caithness:* Langwell (Lillie); Dirlot (Lillie); Latheronwheel (Lillie).

Orkney.—Mill Burn, Hoy (Lillie).

Shetland.—Unst (Sim); Lerwick (West); Necans (Beeby); Sullam (Sim); Mavisgrind (Sim); Northmavin (Sim); Sandwater (Beeby).

var. æruginosa *Hook.*

S.E. Lowlands.—*Kirkcudbright:* New Galloway (M'And.); Penkill Burn (Macv.). *Wigtown:* Cairnryan (Macv.).

E. Lowlands.—*Peebles:* Portmore (Evans).

S.E. Highlands.—*Fife and Kinross:* Kiels Den, 1864 (How.); Cambo (Young).

E. Stirling.—Bridge of Allan (Grev. Herb.); Wester Glen (Kids. and Stir.). *S. Perth:* Nr. Doune (Kids. and Stir.). *Mid Perth:* Ben Lawers (Grev.).

Mid E. Highlands.—*Forfar:* Rescobie, 1846 (Gard.).

Metzgeria conjugata *Lindb.*

Widely distributed from Dumfries to Orkney, but in general less common than *M. furcata*. It prefers moister and more shady localities, and is usually confined to rocks.

In the West Lowlands it is frequent in several of the glens, but is rare in the upper parts of the valleys, where there is little shelter. Is very rare in the East Lowlands, and is usually found only in shady subalpine glens. It is rare in Fife and generally over the drier districts of the East Highlands, but is rather common in the hilly districts. Is common in the West Highlands, less so in the unsheltered Hebrides. Is frequent in West Ross-shire, but is uncommon in the extreme north. It is uncommon on the hills, but ascends to 2600 ft. alt. in Perthshire. Fruit is uncommon, and mature from September to May.

S.W. Lowlands.—*Dumfries:* Penton Linns, on limestone rocks (Scott); Crawick Water, v.r. (Macv.). *Kirkcudbright:* New Galloway (M'And.); Loch Trool, f. (Macv.); Penkill Burn (Macv.). *Wigtown:* Loch Ryan (Ewing); Cairnryan (Macv.); Dunsky Glen, f. (Macv.).

N.W. Lowlands.—*Ayr:* Beith (Ewing); Largs (J. Murr.); Glen Afton, rock, r. (Macv.). *Renfrew:* Lochwinnoch (Ewing); Loch Thom (Ewing); Inverkip (Lee); Glen, Misty Law (Scott). *Lanark:* S. of Elvanfoot, on rocks by stream side, v.r. (Macv.).

E. Lowlands. — *Peebles:* Cowie's Linn (M'And.). *Berwick:* Cockburnspath (M'And.). *Edinburgh:* Pentland Hills (Grev.); Nether Habbie's Howe (Evans); Moorfoot Water (Evans).

S.E. Highlands.—*Fife and Kinross:* Rumbling Bridge (Ewing); Raith (Young); Aberdour (Evans); Glen Queich (Evans). *E. Stirling:* Baston Burn, cfr. (K. & S.); Touch (K. & S.); hills above Gargunnock (K. & S.). *S. Perth:* Strathyre, r.c. also cfr. (Macv.); Menstrie Glen K. & S.); Castle Campbell (Evans); Trossachs (Ewing); Aberfoyle (Evans). *Mid Perth:* Killin (G. A. Holt *cf.* Pears. Hep. Brit., p. 464); do., c. on low ground, u. on the hills to 2600 ft. (Macv.); Clifton Burn, Tyndrum (Macv.); Ben Laoigh (Macv.); Falls of Moness, cfr. (J. Menzies); Craig Vinean (M'In.). *N. Perth:* Den of Reichip (Barker); Cally (M'In.); Glen Thaitneich (Ew. and Young).

Mid E. Highlands.—*Forfar:* Craig's Wood nr. Montrose, 1856 (Croall); The Burn nr. Forfar, 1862 (Croall); Auchphersie (Ferg.); Reeky Linn (Aimer). *Kincardine:* Den

of Parlie? (Sim). *S. Aberdeen:* Braemar, 1822 (Grev.); Linn of Corriemulzie, 1845 (Gard.); Burn of Vat (Sim); Den of Finzean (Sim); Ben MacDhui (Stabl.).

N.E. Highlands.—*Elgin:* Banks of the Findhorn above Slui, 1848 (Croall). *E. Inverness:* Kilverock Wood, Nairn, 1846 (Croall); Cawdor, Nairn, cfr., 1862 (Croall); Invercannich (Cocks).

W. Highlands.—*Kintyre:* Without nearer locality (Ewing); Clachan (Macrae); Ronachan (Macrae); nr. Tarbert (Ewing); *Clyde Isles:* Cnocan Burn, Arran (Campb.); Loch Ranza, R. (Macv.); Kyles of Bute (Ewing). *Dumbarton:* Ben Vorlich (Barker); Ardlui, F. (Macv.); Arrochar, C. (Macv.). *Argyll:* Coire Athoich, cfr. (A. Murr.); Loch Awe district, F. in ravines (Macv.); Glen Nant, F. (Macv.); Kentallen (Macv.); Ballachulish (Macv.). *W. Inverness:* Moidart, C. cfr. (Macv.); Ardnamurchan, C. (Macv.); Sunart, C. (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Ardimersay, Islay, cfr. (Gilm.); Bridgend, Islay (Gilm.). *Mid Inner Hebrides:* Tobermory (Ewing); Aros (Kenn.); do., U. (Macv.); Allt na Searmoin, Salen (Kenn.). *N. Inner Hebrides:* Skye, without locality (Weiss.); Mill Burn, Broadford, cfr. R. (Macv.); Sligachan (Miss Macv.).

Outer Hebrides.—Tarbert (West); Balallan (West).

Lower N. Highlands.—*W. Ross:* Strathcarron, F. in ravines (Macv.); Strome Ferry (Macv.). *E. Ross:* Without other locality, 1872 (Barker).

Upper N. Highlands.—*W. Sutherland:* Strath Naver (Lillie). *Caithness:* Dunbeath Strath (Lillie); Achorn (Lillie).

Orkney.—Quoyowa, Hoy (Lillie).

Metzgeria hamata *Lindb.*

Widely distributed from Wigtown to Orkney, but almost confined to the west side of the country. It is rare in the West Lowlands and has not been found in the East Lowlands. In several parts of the western portion of the East Highlands it occurs, and occasionally in some quantity; but it has not been found near the eastern side of that province except in two localities, one of which being in

Kinross of an old date, and of which the specimen had better be re-examined, and the other in Aberdeen, of which I have not seen a specimen. It is generally distributed in the West Highlands, being frequent in many parts, and is found in large quantity in some places. Is uncommon in the Inner Hebrides and has not been yet found in the Outer Islands, the absence of shelter in the Hebrides being unfavourable for this species. It extends along the west side of the North Highlands, but has not been found in the extreme north of the mainland or in Shetland. It is rare in Orkney.

This species usually grows on wet rocks in well-sheltered ravines, and when these are not present the plant is rare or absent. It is a low ground-plant, but is found occasionally on the hills up to 1800 ft. alt. It frequently forms large yellowish-green patches of a foot or more in diameter in ravines when near the west coast, but it is frequent also as thin layers over mosses, the latter being its usual condition when on the hills. The plant is most commonly without inflorescence; fruit has not been seen.

S.W. Lowlands.—*Kirkcudbright:* Ballingear Glen, New Galloway (M'And.).

N.W. Lowlands.—*Ayr:* West Kilbride, 1887 (Ewing); Ness Glen, Dalmellington, 1888 (M'And.). *Renfrew:* Glen N. of Glenlora, Misty Law (Scott).

S.E. Highlands.—*Fife and Kinross:* Nr. Kinross, 1844 (Stark)? *Mid Perth:* Ben Lawers, 1837 (Grev. Herb.); Finlarig Burn, R.C. (Macv.); Craig-an-Lochain, alt. 1800 ft. (Macv.); Craig Mhor (Young); Ben Laoigh in several places from 1600–1800 ft. (Macv.).

W. Highlands.—*Clyde Isles:* Goatfell (Campb.); L. Ranza, V.R. (Macv.); Benlister Glen, Lamlash (M'And.). *Dumbarton:* Ravine, Ben Vorlich (Macv.); Arrochar Wood, F. (Macv.); ravine nr. Arrochar Station, R. (Macv.). *Argyll:* Lochgoilhead, 1856 (Nichol); Allt Coire Gabhail, Glencoe (Dixon); Puck's Glen (A. Murr.); Ben More (A. Murr.); Tailor's Leap, Glen Nant, R. (Macv.); Kentallen, F. (Macv.); Glen Ure, Benderloch (Kenn.). *W. Inverness:* Moidart, C. in some ravines, R. on the hills to 1700 ft. (Macv.); Ardnamurchan, F. in ravines (Macv.); Resipol Burn, Sunart, C. (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Jura (Ewing). *Mid Inner Hebrides:* Nr. Tobermory (Kenn.); Allt na Searmoin, Salen (Kenn.).

Lower N. Highlands.—*W. Ross*: Strome Ferry, f. (Macv.); Strathcarron, r. (Macv.).

Orkney.—Side of sandy lochs near the Ward Hill, Hoy (Lillie).

Metzgeria pubescens (*Schrank*) *Raddi*

A rare species almost confined to the East Highlands, though found from Dumfries to Caithness. Is very rare in the Lowlands. It has been found in a few localities in Fife, is frequent in some of the hilly districts of the East Highlands, and is common on a few of the Breadalbane hills where there is some lime in the soil. It is very rare in the West Highlands, and has only been found there in one of the limestone districts. On the east side of the country it is sometimes found on basalt. It has an eastern distribution in Scotland, and is mostly a subalpine and alpine species. It grows on rocks, usually in tufts of mosses, and extends to 4000 ft. alt.

Male plants appear to be not uncommon. Fruit has not been found.

S.W. Lowlands. — *Dumfries:* Penton Linns, on limestone rocks (Scott).

E. Lowlands. — *Edinburgh:* Craiglockhart Rocks (M'And.); Moorfoot Water (Evans).

S.E. Highlands.—*Fife and Kinross:* Rocks nr. Balincrino, 1845 (Gard.); Dunearn Hill, on basalt (Young); rocks above Newburgh (How.); Glen Queich (Evans); *E. Stirling:* Gargunnock Craigs (Kids. and Stir.). *Mid Perth:* Craig-an-Lochain, Killin, c. (Macv.); Ben Lawers, f. to 4000 ft. (Macv.); Ben Laoigh (West); do., f. (Macv.); Falls of Ness nr. Muthill (Evans). *N. Perth:* Glen Tilt (Ferg.); Glen Shee (Ferg.).

Mid E. Highlands.—*Forfar:* Falls of Melgum, 1837 (Edin. Herb.); Den of Airlie, 1842 (Gard.); Reeky Linn (Gard.); do. (Croall); do. (Aimer); Clova (Ferg.); The Burn (Croall); Fern (Ferg.). *Kincardine:* Den of Garol (Sim); Paldy Hill (Sim). *S. Aberdeen:* Linn of Corrie-

mulzie, 1845 (Gard.); Lion's Face, Braemar (Stabl.). *N. Aberdeen:* Huntly (M'And.).

N.E. HIGHLANDS.—*Banff:* Loch Builg (Dickie). *E. Inverness:* Invercannich (Cocks); Farr Rocks, Kincraig (Miss Macv.).

W. HIGHLANDS.—*Argyll:* Lismore (Macv.).

LOWER N. HIGHLANDS.—*E. Ross:* Balnakil, Durness (Lillie).

UPPER N. HIGHLANDS.—*Caithness:* Reisgill Burn (Lillie).

PALLAVICINIA S. F. Gray

Dilæna Dum.

[PALLAVICINIA LYELLII (*Hook.*) *Gray*

It is doubtful if this species has been found in Scotland. It was recorded by J. Cruickshank in the *Phytologist*, 1842, from the Lochar Moss near Dumfries, and this record is quoted by Pearson in *Hep. Brit. Isles*, but Mr Pearson tells me that he has not seen a specimen from this locality, and he agrees with me that it is advisable that the plant be gathered again before entering it definitely as a Scottish species. There is an unlocalised specimen of this species in John Sim's Herbarium, but this collection contains a few English and American, as well as Scottish, plants, and there is no indication of the county in this case. As the species has been found as far north as Westmorland, it may possibly occur in Dumfries.]

PALLAVICINIA HIBERNICA (*Hook.*) *Gray*

This rare species has only been found in two localities, and not in recent years. The altitude at which it was found in Forfar is not stated, but Cat Law is slightly under 2000 ft. alt. The Shetland station is perhaps near sea-level.

MID E. HIGHLANDS.—*Forfar:* Cat Law, 1822 (C. Lyell).

SHETLAND.—Burn of Vallor, 1878 (Sim).

PALLAVICINIA FLOTOWIANA (*Nees*) *Lindb.*

Mörckia hibernica v. *Wilsoniana* Gottsche

This species is almost confined to damp, sandy ground near the sea. It is to be expected that it will be found in

other sand-dunes on our coasts besides those recorded here, especially in the southern part of the country, and on the west as well as on the east coast.

E. Lowlands.—*Haddington:* Gullane Links, per., 1906, with *Hypnum falcatum*, *H. cordifolium*, *H. revolvens*, *Amblystegium filicinum* (M'And.); do., with *Aneura pinguis*, *A. multifida*, *Pellia epiphylla*, *Marchantia*, *Preissia* (Evans).

S.E. Highlands.—*Fife and Kinross:* Tents Muir, 1890 (W. Smith).

Mid E. Highlands.—*Forfar:* Drumly Airly, 1815 (C. Lyell).

Pallavicinia Blyttii (*Mörck.*) *Lindb.*

Mörckia norvegica Gottsche

This alpine species is confined to some of the higher mountains in the Highlands, where it is occasionally to be found in some quantity. The upper parts of most of the highest mountains in the West Highlands and Hebrides are bare and stony, and are almost devoid of vegetation. This is also the case over a large part of the North Highlands. On such hills there are few habitats for this species, which prefers small vertical banks on grassy slopes. There is little doubt that it is a species which has been a good deal overlooked, and it may perhaps be found to occur on most of our hills of above 3300 ft. alt. which have soil near their summits. It forms broad yellowish-green patches on moist soil, rarely in wet ground, from 3100–3800 ft. alt. Fruit, which is mature in July and August, is common.

S.E. Highlands.—*Mid Perth:* Ben Lawers, cfr., 1839 (W. W. Evans); do., in several places, alt. 3100–3400 ft. (Macv.); Ben Heasgarnich, nr. the summit (Cocks); Am Binnean, cfr. (Ewing).

Mid E. Highlands.—*Forfar:* Camlochan, 1873 (Ferg.); do., cfr., 1904 (Ew. and Young). *S. Aberdeen:* Lochnagar with *Calypogeia Trichomanis*, 1884 (Stabl.).

N.E. Highlands.—*Banff:* Rocks above Loch Avon, alt. 3800 ft., cfr. (A. Wilson and J. A. Wheldon). *E. Inverness:* summit of Mam Soul, alt. 3800 ft., with *Polytrichum sex-*

angulare (Cocks): Braeriach, alt. 2500 ft., with *Lophozia alpestris* (J. A. Wheldon and A. Wilson).

W. Highlands.—*W. Inverness:* Ben Nevis, alt. 3600 ft. (J. B. Duncan and H. H. Knight).

Lower N. Highlands.—*E. Ross:* Ben Wyvis, 1888 (G. E. Davis *cf.* Pears. Hep. Brit., p. 439); Scuir na Lapaich, cfr. "rather plentiful" (Cocks).

PELLIA Raddi

Pellia endiviæfolia (*Dicks.*) *Dum.*

P. Fabbroniana Raddi
Jung. calycina Tayl.

A widely distributed and frequent species from Dumfries to Orkney, but nowhere common. It is more frequent in the Lowlands than in the Highlands, and appears to be more so in the East Lowlands than elsewhere. It is frequent as far north as Caithness, but has not been found in Shetland. It is entirely confined to the low ground, and generally occurs at the foot of wet rocks; it is sometimes also found at the side of springs. It occurs on various formations, but has a distinct preference for limestone. Fruit is frequent, but not common, and matures in March and April.

In sylvis humidis Scotiæ (Arch. Menzies *cf.* Dicks. Pl. Crypt., Fasc. iv. p. 19, 1801).

S.W. Lowlands. — *Dumfries:* Dumfries, cfr., 1859 (Dr Gilchrist); entrance to Dalveen Pass (Scott); Crawick Water (Macv.). *Kirkcudbright:* New Galloway (M'And.). *Wigtown:* Dunsky Glen (Macv.).

N.W. Lowlands.—*Ayr:* Fairlie (Ewing); Mauchline, cfr. (Ewing). *Renfrew:* Glen, Misty Law (Scott); Cloch (Macv.). *Lanark:* Uddingston (Ewing); Elvanfoot (Macv.).

E. Lowlands.—*Peebles:* Medwyn Water (Evans). *Selkirk:* Crossclough Burn (Evans); Bowhill (Evans); Caddon Water (Macv.); Glenkinnon Burn (Macv.); Lindean (Macv.). *Roxburgh:* Kelso (Scott); Melrose district, R.C. (Macv.); Hawick (Macv.). *Berwick:* Cockburnspath (M'And.). *Haddington:* Dunglass (M'And.); Haddington (Evans).

Edinburgh: Logan Burn (A. Murr.); Polton (M'And.); Torduff (M'And.); Cramond (Evans); Dalmahoy (M'And.). *Linlithgow:* Carriber Glen (Evans); nr. S. Queensferry (M'And.).

S.E. Highlands.—*Fife and Kinross:* Raith (Young); Kinghorn Loch (M'And.); N. Queensferry (M'And.); Aberdour (M'And.). *E. Stirling:* Boquhan Glen (K. & S.). *S. Perth:* Menstrie Glen (Evans); Tillicoultry Glen (Evans); Wharry Rest, Bridge of Allan (Evans). *Mid Perth:* Glen Farg (J. Fulton); Cherrybank nr. Perth, cfr. (Meld.). *N. Perth:* Den of Reichip (M'In.).

Mid E. Highlands.—*Forfar:* Sidlaw Hills, cfr., 1840 (Gard.); Den of Airlie (Ferg.); Fern (Ferg.); Gannochy (Ferg.); Reeky Linn (Aimer). *Kincardine:* Blackhall (Sim). *S. Aberdeen:* Potarch (Sim).

W. Highlands.—*Kintyre:* Without other locality, 1850 (Kerr); Ardrishaig (Ewing); Clachan, cfr. (Macrae); Tarbert (Ewing). *Clyde Isles:* Loch Ranza (Macv.). *Dumbarton:* Arrochar (Macv.). *W. Stirling:* Campsie Glen, cfr. 1831 (Grev. Herb). *Argyll:* Tailor's Leap, Glen Nant (Macv.). *W. Inverness:* Moidart, f. and cfr. u. (Macv.); Sunart, f. (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Jura (Ewing); Ardtalla, Islay (Gilm.); Bridgend, Islay (Gilm.). *Mid Inner Hebrides:* Nr. Tobermory (Kenn.); Achnadrish (Macv.). *N. Inner Hebrides:* Mill Burn, Broadford (Macv.).

Lower N. Highlands.—*W. Ross:* Strome Ferry (Macv.); Strathcarron (Macv.). *E. Ross:* Fortrose and Rosemarkie, several places (Miss Macv.).

Upper N. Highlands.—*Caithness:* Watten, cfr. (Lillie).

Orkney.—Finstown (West); Stromness (Lillie).

Pellia Neesiana (*Gottsche*) *Limpr.*

Uncommon in the Lowlands, where it is usually found in the subalpine region, frequent in the Highlands and extending to Shetland. It appears to be more common than *P. epiphylla* towards the upper parts of the higher mountains of the Eastern Highlands and ascends to 3300 ft. alt., but the sterile forms common at the side of rills at high elevations cannot be distinguished from each other.

It is frequent on the low ground of the West Highlands, but seems to be less so in the Hebrides. The early period of fruiting makes its general distribution imperfectly known. When on the low ground it is commonly found on wet grassy ground, but when on the mountains it is generally at the side of rills.

Fruit, which matures in April and May, and on the hills also in June, is frequent, more so than in *P. endiviæfolia*; and male and female plants usually occur together, which is not the case in the latter species.

N.W. Lowlands.—*Renfrew:* Cloch (Ewing). *Lanark:* Kirk Burn, Tinto (Macv.); Green Lowther, alt. 1800 ft. (Macv.).

E. Lowlands.—*Peebles:* Nr. Carlops, cfr. (Evans). *Selkirk:* Crosscleugh Burn (Evans). *Edinburgh:* Allermuir Glen (Evans); Crosswood Burn, cfr. (Evans).

S.E. Highlands. — *Fife and Kinross:* Lomond Hills (Young). *E. Stirling:* Gargunnock, moor above Redhall Farm, cfr. (K. & S.). *S. Perth:* Strathyre (Macv.); Aberfoyle, cfr. (Evans). *Mid Perth:* Ben Laoigh (Ewing); Killin district, f. especially on the hills to 3300 ft., also cfr. (Macv.). *N. Perth:* Glen Beg, Glen Shee (Ferg.).

Mid E. Highlands.—*Forfar:* Clova (G. West and Miss H. Ogilvie).

N.E. Highlands.—*Elgin:* Glen Beg nr. Grantown (Miss Macv.). *E. Inverness:* Corrie Schneada, Cairngorm, alt. 3200 ft. (Macv.); Loch Insh (Miss Macv.).

W. Highlands. — *Dumbarton:* Ardlui, wet grassy ground (Macv.); Loch Humphrey, cfr. (Ewing). *Argyll:* Taynuilt, wet grassy ground (Macv.). *W. Inverness:* Moidart, f. (Macv.); Resipol Burn, Sunart, f. (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Ardbeg, Islay (Gilm.).

Lower N. Highlands.—*W. Ross:* Strathcarron, on wet grassy ground (Macv.). *E. Ross:* Achnasheen, on wet grassy ground (Macv.).

Upper N. Highlands.—*E. Sutherland:* Allt-na-Muich (Lillie). *Caithness:* East Watten Moss (Lillie); Dunnet Links (Lillie); Achavanich (Lillie).

Orkney.—Finstown (West).

SHETLAND.—Burn of Fetter, Clousta Voe (Beeby); South Clousta Voe (Grieve); Lerwick (West).

PELLIA EPIPHYLLA (*L.*) *Dum.*

The most common and widely spread hepatic in Scotland, both on the low ground and on the hills to 3000 ft. alt. at least. It is found on almost every kind of moist or wet ground, especially moist banks, side of ditches and streams, and among wet rocks generally. It is also common in marshy ground, but less so when peaty. The narrow undulate forms of wet ground are usually sterile, but otherwise the species fruits abundantly from March to May.

S.W. LOWLANDS. — *Dumfries:* Brownhall, cfr. 1840 (Cruicks.); Whitecombe, cfr. (Johns.); Moffat (Miss Macv.); Sanquhar district, v.c. (Macv.); Crichope Linn, c. (Macv.). *Kirkcudbright:* New Galloway (M'And.); Glen Trool, c. (Macv.); Penkill Burn, c. (Macv.); Creetown (Macv.). *Wigtown:* Loch Ryan (Ewing); Stranraer district, c. (Macv.); Portpatrick, c. (Macv.); Glenluce, c. (Macv.).

N.W. LOWLANDS. — *Ayr:* Auchenleck (Ewing); Afton Water, c. (Macv.). *Renfrew:* Gourock (Ewing); Misty Law (Scott). *Lanark:* Hamilton Woods and Barncluith (Hopk. *cf.* Fl. Glott., p. 140); Clyde, cfr. (J. Murr.); Holland Bush, cfr. (J. Murr.); Abington, cfr. (Ewing); Cartland Crags, c. (Macv.); Carstairs Moss, c. (Macv.); Tinto (Macv.); Elvanfoot district, v. except at sides of some streams (Macv.); Green Lowther, R.C. (Macv.).

E. LOWLANDS.—*Peebles:* Cowie's Linn, cfr. (A. Murr.); Carton Burn, c. (Macv.); Tweedsmuir, c. (Macv.). *Selkirk:* Crossclough Burn (Evans); Bowhill (Evans); Caddon W. (Macv.); Glenkinnon Burn, c. (Macv.); Lindean (Macv.); Galashiels (Macv.). *Roxburgh:* Fernieherst, cfr. (Miss Macv.); Melrose district, c. (Macv.); Hawick (Macv.). *Berwick:* Pease Dean, c. (Macv.); Longformacus (Miss Macv.). *Haddington:* Ormiston Woods, cfr. (Evans); Dunglass, cfr. (Evans); Gullane Links, cfr. (M'And.). *Edinburgh:* Roslin (Dr Parsons *cf.* Lightf. Fl. Scot., p. 788); Mavisbank, cfr. (Grev. Herb.); nr. Edinburgh (Grev.); Auchendinny Woods, cfr., 1845 (W. W. Evans);

Whitehill Glen (Evans): Redford Wood, cfr. (M'And.). *Linlithgow:* Riccarton Hills (Evans).

S.E. HIGHLANDS.—*Fife and Kinross:* Dysart Woods, cfr., 1847 (W. W. Evans); St Andrews (Macv.); Dunniskin Wood, cfr. (Young); Lomond Hills, cfr. (Young); Cullalo Wood (Evans). *E. Stirling:* Gargunnock, cfr. (K. & S.); Wester Glen (K. & S.). *S. Perth:* Strathyre, v.c. (Macv.); Aberfoyle, cfr. (Evans); Trossachs, cfr. (Ewing). *Mid Perth:* Killin district, c. on low ground and on the hills to 3000 ft. (Macv.); Tyndrum district, do. (Macv.); Craig Vinean, cfr. (M'In.). *N. Perth:* Glen Thaitneich, Glen Shee (Ferg.); Dunkeld, cfr. (M'In.).

MID E. HIGHLANDS.—*Forfar:* Guthrie Woods, 1839 (Croall); Emmoch Wood, cfr. (Aimer). *Kincardine:* Commonty, Strachan (Sim). *S. Aberdeen:* Ferry Hill moss, cfr., 1837 (Dickie); Den of Maiden Craig, cfr. (Dickie); Potarch (Sim). *N. Aberdeen:* Mormond Hill (Ewing); Turiff (Lillie).

N.E. HIGHLANDS.—*Elgin:* Above Sluie, 1848 (Croall); Grantown, several places (Miss Macv.); Lochan Dorb (Miss Macv.). *E. Inverness:* Aviemore, many places, as Druie River, Loch Vaa, etc. (Macv.); Carr Bridge (Miss Macv.); Glen Tromie (Miss Macv.); Kincraig (Miss Macv.); Fort Augustus (Macv.).

W. HIGHLANDS.—*Kintyre:* Clachan (Macrae). *Clyde Isles:* Bute (Ewing); Loch Ranza, v.c. (Macv.). *Dumbarton:* Helensburgh, cfr. (Ewing); Arrochar, c. (Macv.); Ardlui, c. (Macv.); Shandon (Miss P. Macv.); Tarbert, c. (Macv.). *W. Inverness:* Inversnaid, c. (Macv.). *Argyll:* Glencoe (Macv.); Loch Awe district, v.c. on low ground and on the hills (Macv.); Glen Nant, c. (Macv.); Ben Udlaidh, c. (Macv.); head of Loch Long (Macv.); L. Tulla, v.c. (Macv.); Ben Doureann (Macv.); Ben Arthur, v.c. to 2700 ft. alt. (Macv.); Kentallen, c. (Macv.); Ballachulish (Macv.); Sandbank (Ewing). *W. Inverness:* Moidart, v.c. (Macv.); Ardnamurchan, v.c. (Macv.); Sunart, v.c. (Macv.); Glen Nevis, c. (Macv.); Ben Nevis (Macv.); Spean Bridge (Miss Macv.).

INNER HEBRIDES.—*S. Inner Hebrides:* Ardimersay (Gilm.); Ardtalla Glen, cfr. (Gilm.); Ardbeg (Gilm.). *Mid Inner Hebrides:* Tobermory (Ewing); Aros (Kenn.); N.

of Mull, v.c. (Macv.); Ben More (Kenn.); Glen Forsa (Kenn.). *N. Inner Hebrides:* Broadford district, c. (Macv.); Sligachan (Miss Macv.).

Outer Hebrides.—Benbecula (Ewing); Stornoway, cfr. (Gibs.); Tarbert (West); Balallan (West); Harris, cfr. (Ewing).

Lower N. Highlands.—*W. Ross:* Strome Ferry, v.c. (Macv.); Strathcarron, v.c. (Macv.); Achnashellach (West); Gairloch (Miss Macv.); Loch Maree (Miss Macv.). *E. Ross:* Achnasheen, v.c. (Macv.); Loch Luichart (West); Rosemarkie (Miss Macv.).

Upper N. Highlands.—*E. Sutherland:* Ben Griam Mohr, cfr. (Lillie). *W. Ross:* Ben Clibreck (Lillie). *Caithness:* Bilbster, cfr. (Lillie); Watten, cfr. (Lillie).

Orkney.—Hoy, several places (West); Finstown (West); Kirkwall (West).

Shetland.—Nr. Clousta (Beeby); Gellie Gill nr. Hillswick (Beeby); Tresta (Beeby); Uyea (Beeby); Whalsey (Lillie).

BLASIA L.

Blasia pusilla *L.*

Widely distributed from Dumfries to Caithness and Shetland, but can hardly be considered as a common species in Scotland. In the Lowlands it is uncommon and usually confined to subalpine districts, though also found at sea-level. It is general over the Highlands, and is rather more plentiful in the central parts and east than in the west. It has not yet been found in the Inner Hebrides or in Orkney. It grows on damp roadsides and gravelly roadside ditches. Is rare on the hills, where it is found on moist gravelly or clay ground, ascending to 2600 ft. alt. in Mid Perth, and to 3400 ft. alt. in North Perth.

Fruit, which matures in March and April, has only been found on a few occasions.

S.W. Lowlands.—*Dumfries:* Crawick Water, v.r. (Macv.). *Kirkcudbright:* Clouden Craigs, cfr., 1840 (Cruicks.); New Galloway (M'And.). *Wigtown:* Nr. Portpatrick (M'And.); Loch Ryan (Ewing); Aldouran Glen, roadside (Macv.); Glenluce (Macv.).

N.W. Lowlands.—*Ayr:* Darvel (Ewing). *Renfrew:* Gourock, 1838 (Gour.); do. 1894 (J. Murr.); Glen, Misty Law (Scott). *Lanark:* Stonehouse (J. Murr.); Wabston (Ewing); Falls of Clyde (Young); Elvanfoot district, v.r. (Macv.).

E. Lowlands.—*Peebles:* Nr. Cowie's Linn (A. Murr.); Carton Burn, alt. 1200 ft. (Macv.); Talla W., alt. 900 ft. (Macv.). *Selkirk:* Crossleugh Burn (Evans). *Berwick:* Cockburnspath (M'And.). *Edinburgh:* Auchendinny, cfr. (Grev. *cf.* Fl. Edin., p. 271); Arniston Woods, cfr. (Grev. *loc. cit.*); Roslin Woods, cfr. (Grev.); Nether Habbie's Howe (Evans); Newpark (Evans); Glencorse (M'And.); nr. Pomathorn, roadside (Evans). *Linlithgow:* Nr. Bathgate (Evans).

S.E. Highlands.—*Fife and Kinross:* Glen Burn, cfr. (Evans); Tents Muir (Evans); Pouring Den, roadside (Young). *S. Perth:* Aberfoyle (Evans); Trossachs (Ewing); Inverlochlarig (Evans); Strathyre (Macv.). *Mid Perth:* Killin district, c. on the low ground, r. on the hills, as Creag-na-Lochain, alt. 1900 ft. (Macv.); Clifton Burn, Tyndrum (Macv.); Achrioch Burn (Macv.); Ben Laoigh, alt. 1200–2600 ft., r. (Macv.); nr. Methven (Meld.). *N. Perth:* Glen Shee (Ferg.); Glen Thulachan, alt. 3400 ft. (Ferg.); Dunkeld (M'In.).

Mid E. Highlands.—*Forfar:* Kinnordy, cfr. (Lyell *cf.* Hook. Fl. Scot., p. 118); Reeky Linn, cfr., 1842 (Gard.); do., 1906 (Aimer); nr. Monifieth (Gard.); The Burn (Croall); Fern (Ferg.). *Kincardine:* Invey Woods (Sim); Gellon (Sim); Blackness (Sim). *S. Aberdeen:* Aberdeen, cfr., 1835 (Dickie); Old Bridge of Dee, cfr., 1836 (Dickie); Ballochbuie (Croall); Potarch (Sim).

N.E. Highlands.—*Elgin:* Den of Shogle, cfr., 1845 (Croall); Dreggie Burn (Miss Macv.); Glen Beg nr. Grantown (Miss Macv.). *E. Inverness:* Aviemore (Macv.); Glen Tromie, several places (Miss Macv.).

W. Highlands.—*Kintyre:* Without nearer locality, 1850 (Kerr); Campbeltown (Ewing). *Clyde Isles:* Bute (Ewing). *Dumbarton:* Ardlui (Macv.); Arrochar Woods, on roadside ditch, etc., v.c. (Macv.); ravine nr. Arrochar Station, u. (Macv.). *Argyll:* Dunoon (Ewing); Lochgilphead (Ewing); Loch Awe Station, on roadside ditch, r.

(Macv.); Loch Blie, on roadside ditch, c. (Macv.); Loch Tulla, roadside (Macv.). *W. Inverness:* Moidart, f. (Macv.); Sunart, f., cfr. r. (Macv.); Fort William, wet rocks on seashore (Macv.); Loch Laggan (Miss Macv.).

Lower N. Highlands.—*W. Ross:* Strathcarron, l.c. (Macv.); Achnashellach (West). *E. Ross:* Achnasheen, v.c. at side of stream (Macv.); Loch Luichart (West); Fairy Glen, Rosemarkie (Miss Macv.).

Upper N. Highlands.—*E. Sutherland:* Strath Ullie (Lillie). *W. Sutherland:* Strath Halladale (Lillie). *Caithness:* Watten (Lillie); Strath of Bilbster (Lillie).

Shetland.—Unst (Lillie).

FOSSOMBRONIA Raddi

Fossombronia Dumortieri (*Hub. et Genth.*) *Lindb.*

Has been found only in a few widely spread districts from the extreme south to East Inverness. It appears to be most frequent in the East Highlands. Occurs on sandy, peaty moors, and in hollows in sandy ground where vegetation collects and decays, as at the sides of inland lochs. Fruit, mature from July to November, is common.

S.W. Lowlands.—*Wigtown:* Garliestown, 1889 (M'And.).

S.E. Highlands.—*Mid Perth:* On sandy flats, head of Loch Tay, 1898 (Young).

N.E. Highlands.—*E. Inverness:* Peat-moss nr. Carr Bridge, 1904 (Miss Macv.); shore of Loch Insh (Miss Macv.).

Fossombronia Wondraczekii (*Corda*) *Dum.*

F. cristata Lindb.

This species has been found from Peebles to Caithness on the east side of the country, and in the Inner Hebrides and West Inverness on the west. As with the other small species which are usually to be found in a condition for identification late in the season, it is mostly in districts with a resident botanist that the presence of this species is known. Most of its localities at present are on the east side of the country, but in the best-searched district of the

West Highlands, *i.e.* West Inverness, it is frequent. While *F. pusilla*, which is of a more Southern type, is the more common plant in the Lowlands, this is the more common in the Highlands. Also its localities in the Lowlands are mostly of a higher altitude than are those of *F. pusilla*, although the highest is hardly above 1000 ft. to 1200 ft. alt. Occurs in small light-green patches on moist loamy soil on fallow ground, footpaths, sides of ditches, and at the sides of reservoirs and ponds. Fruit, mature from July to November, is generally present, but not commonly before the middle to end of August.

E. Lowlands.—*Peebles:* Portmore Loch (Evans); nr. Carlops (Evans); Logan Water, alt. 1000 ft. (Macv.). *Edinburgh:* Braid Hills, on margin of skating pond (Evans); Glencorse Reservoir (Evans); Thriepmuir Reservoir (M'And.); Rosebery Reservoir (Evans). *Linlithgow:* Nr. Bathgate (Evans); Drumshoreland Curling Pond, Broxburn (M'And.).

S.E. Highlands.—*Mid Perth:* Tibbermore (Meld.).

Mid E. Highlands.—*Forfar:* Fern, 1878 (Ferg.).

W. Highlands.—*W. Inverness:* Moidart, fallow fields and ditch-sides, f. (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Jura (Ewing). *Mid Inner Hebrides:* Nr. Tobermory, side of path (Macv.); Dervaig, ditch-side (Macv.).

Upper N. Highlands.—*Caithness:* Watten (Lillie).

Fossombronia pusilla (*L.*) *Dum.*

Distributed from Dumfries and Berwick to West Inverness and Caithness. Most of the localities at present known are from the west side of the country. It appears to be rather frequent in the West Lowlands, and rare in the East Lowlands. Is probably also rare in the East Highlands, and is uncommon in the West Highlands. Our knowledge of its distribution, as in the case of the previous species, is mostly confined to districts where there is a resident botanist. It forms rather larger patches as a rule than *F. Wondraczekii*, and has a more powerful odour. It grows on bare, moist, loamy soil, in fields and gardens and on banks, but it has not been found on the mud at the side of

reservoirs, as in the case of the preceding species. Fruit is generally present and mature in late autumn, and extends from August to April.

S.W. Lowlands.—*Dumfries:* Brownhall nr. Dumfries, 1840 (Gray). *Kirkcudbright:* New Galloway (M'And.). *Wigtown:* Portpatrick, side of field (M'And.).

N.W. Lowlands.—*Ayr:* Barskimming, field (Scott); Afton Water, bank (Macv.). *Lanark:* Clyde nr. Uddingston (Ewing).

E. Lowlands.—*Berwick:* Pease Dean (Evans). *Linlithgow:* Drumshoreland, in grass field (Evans); field between Polmont and Manuel (Scott).

Mid E. Highlands.—*Forfar:* Nr. Muir's Den, Dundee (J. Fulton).

W. Highlands.—*Dumbarton:* Cumbernauld (Ewing). *W. Inverness:* Moidart, U. (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Ardbeg, Islay (Gilm.).

Upper N. Highlands.—*Caithness:* Greystones, Watten (Lillie); Swiney, Lybster (Lillie).

HAPLOMITRIUM Nees

Scalia S. F. Gray

Haplomitrium Hookeri (*Sm.*) *Nees*

Is known only from one locality at present, in marshy ground in rather peaty soil near the sea-shore on Loch Moidart. Is a difficult plant to detect in the field, and is probably sometimes overlooked. In the Moidart locality it grows in company with *Aneura pinguis, A. multifida, Hypnum scorpioides, H. revolvens, Heliocharis multicaulis.*

W. Highlands.—*W. Inverness:* Moidart, marshy ground nr. seashore, 1898 (Macv.); do., 1899 (W. H. Pearson).

JUNGERMANNIACEÆ ACROGYNÆ

GYMNOMITRIUM Corda

Cesia S. F. Gray
Acolea Dum.

Gymnomitrium concinnatum (*Lightf.*) *Corda*

Very rare in the Lowlands, having been found only in small quantity on the Kells range of hills in Kirkcudbright, where it descends to 1500 ft. alt., and at the head of Moffatdale. It has not been found in the East Lowlands, but, occurring as it does on the Moffat side of the boundary range between the Solway watershed and that of the Tweed, it is to be expected that it also will be found on the latter. It is common on the higher hills over all the Highlands, descending to 1300 ft. alt. in the eastern district and to 1100 ft. in the western, and to nearly sea-level in Unst, Shetland. It ascends to the summit of Ben Nevis at 4400 ft. alt. It has not been found in the Inner Hebrides, as the higher hills, at least all those examined, are practically devoid of vegetation towards their summits. In the Outer Hebrides, it has only been found near the summit of one of the highest hills. It grows in compact brownish-yellow to white patches on soil and rocks. When at a considerable altitude it usually is found on the former, and occasionally even at rather low elevation. Fruit is common from June to August, but large sterile patches are frequently to be seen.

Upon the rocks on the Highland mountains, frequent (Lightf. *cf.* Fl. Scot., p. 786).

S.W. Lowlands.—*Dumfries:* Hartfell, 1858 (Nich.). *Kirkcudbright:* Kells Hills, alt. *ca.* 1500 ft. (M'And.); Black Craig, New Galloway (M'And.).

S.E. Highlands.—*South Perth:* Ben Aan, Trossachs (Ewing and West). *Mid Perth:* Ben Lawers (Grev.); do., (Dickie); do., c. from 2800–4000 ft. alt. (Macv.); Craig Chailleach, cfr. (Macv.); Am Binnean (Ewing); Meal Ghaordie, cfr. (Ewing); Ben Challum (Barker); Ben Heasgarnich (West); Ben Laoigh (Ewing); Ben Dubh

Craige (Macv.); Ben Odhar, alt. 2900 ft. (Macv.); Sow of Athole, cfr. (Meld.). *N. Perth:* Glas Thalachan, cfr. (Ferg.); Glen Thaitneich (Ferg.); Glen Beg, Glen Shee (Ewing and Young).

Mid E. Highlands.—*Forfar:* Glen Prosen, 1868 (Ferg.); Glen Dole (Barker); Camlochan (Ewing and Young). *Kincardine:* Mount Shade (Sim). *S. Aberdeen:* Lochnagar, 1856 (Croall); do. (Sim); Corrie Ceanmor, several places (West); Glen Beg, Braemar (Stabl.); Ben MacDhui (Stabl.); Morrone (Holmes).

N.E. Highlands.—*Banff:* Ben MacDhui, above Loch Avon (Stabl.). *E. Inverness:* Cairngorm, alt. 4000 ft. (Macv.); Coire Schneada, Cairngorm (Macv.); Glen Tromie, cfr. (Miss Macv.).

W. Highlands.—*Clyde Isles:* Cairn na Cailleach, Arran, cfr. alt. 1100 ft. v.r. (Macv.). *Dumbarton:* Ben Vorlich (Macv.). *Argyll:* Ben Cruachan (T. Rogers *cf.* Pears. Hep. Brit., p. 404); do., cfr. (Macv.); Ben Doureann, cfr. (Ewing and Macv.); summit of Ben Arthur, in quantity, cfr. (Macv.). *W. Inverness:* Glenfinnan (Carr. *cf.* Pears. Hep. Brit., p. 404); Moidart, f. 1400–2800 ft. alt. (Macv.); Coire Dearg, Glen Nevis, alt. 1900 ft. (Macv.); Ben Nevis, alt. 4200 ft. (Macv.); do., among *Lophozia alpestris*, alt. 4400 ft. (West).

Outer Hebrides.—Nr. summit of Clisham, Harris (West).

Upper N. Highlands.—*W. Sutherland:* Ben Clibreck, above 2000 ft. alt. in several places (Lillie). *Caithness:* Morven (Lillie).

var. intermedium *Limpr.*

S.E. Highlands.—*Mid Perth:* Ben Lawers (Scott).

Mid E. Highlands.—*S. Aberdeen:* Coire Ceanmor (Young).

N.E. Highlands.—*E. Inverness:* Mam Soul, cfr. (Cocks).

Shetland.—Unst (Beeby).

Gymnomitrium obtusum (*Lindb.*) *Pears.*

A more common species in general in Scotland, and less exclusively alpine than *G. concinnatum*. It has only been found in one locality in the Lowlands, on a hill of 1100 ft.

alt. near the extreme south. It is common in the Highlands from above 1200 ft. alt. Is much more common in the West Highlands than *G. concinnatum*, also common in the Central Highlands, but apparently not so in the north-east and north of the country, and it has not been recorded from Shetland. It descends to sea-level in West Inverness, but is rare below 800–1000 ft. alt. It rarely descends below 1200 ft. in the East Highlands, but has been found on an isolated hill in Fife at about 400 ft. alt. It is less common than *G. concinnatum* on the summits of the hills, but it ascends to 3900 ft. on Ben Nevis. It grows in compact white or greenish-white, more rarely yellow, patches, on boulders and rocks, less frequently on soil, and never when at low altitudes. Fruit, which is mature from June to August, is common, more so than in *G. concinnatum*.

Scotch Alps (T. Drummond in Ed. Herb.).

S.W. Lowlands. — *Kirkcudbright:* Screel Hill (A. Murr.).

S.E. Highlands.—*Fife and Kinross:* Dunearn Hill, alt. *ca.* 400 ft. (Young). *S. Perth:* Ben Ledi, 1841 (Ed. Herb.); Ben Aan, alt. *ca.* 1700 ft. (Ewing and West). *Mid Perth:* Stuc a Chroin, 1841 (Gard.); Ben Lawers, 1871 (Ferg.); do., c. (Macv.); Craig Chailleach, etc. (Macv.); Ben Heasgarnich (Young); Ben Laoigh (Ewing); do., f. (Macv.); Ben Dubh Craige, f. (Macv.); Am Binnean (Ewing); Meal Ghaordie (Ewing); Ben More (Barker); Coire Ardran, c. from 1600 ft. (Macv.); Sma' Glen (Meld.). *N. Perth:* Glas Thalachan, alt. 3000 ft. (Ferg.); Carn-nan-Sac (Ewing); Glen Shee (Barker); Glen Thaitneich (Barker); Glen Beg, Glen Shee (Ewing and Young).

Mid E. Highlands.—*Forfar:* Clova Mountains, 1824 (Grev.); Glen Dole, 1846 (Gard.); Glen Fee (Ferg.); Loch Brandy (J. Fulton); Camlochan (Ewing and Young). *Kincardine:* Mount Shade (Sim); Slack of Birnie (Sim). *S. Aberdeen:* Glen Callater (Dickie); Lochnagar, 1856 (Croall); do. (Sim); Ben MacDhui (Stabl.); Glen Beg, Braemar (Stabl.); Balmoral (Stabl.); Ballochbuie (Michie); Corrie Ceannor, c/r. (Ewing); Peter's Hill, Birse (Sim); rocks above Powlairs (Sim); Morrone (Holmes).

N.E. Highlands.—*Banff:* Above Loch Avon, Ben Mac-

Dhui (Stabl.). *E. Inverness:* Carn Dearg, Aviemore, alt. 1200 ft. (Macv.); Mam Soul (Cocks).

W. Highlands.—*Dumbarton:* Ben Vorlich, c. from 1100 ft. upwards (Macv.). *W. Stirling:* Ben Lomond (Ewing). *Argyll:* Coire Gabhail, Glencoe, alt. 1000 ft., c. (Macv.); Ben Cruachan, r.c. from 1200 ft. upwards (Macv.); Ben Doureamn, cfr. (Ewing and Macv.); Ben an Dothaidh, cfr. (Ewing and Macv.); Ben Arthur, 1300–1900 ft., f. (Macv.). *W. Inverness:* Ben Nevis, 1821 (Grev.); do. to 3900 ft. at least, cfr. (Macv.); Coire Dearg, Glen Nevis (Macv.); Moidart, c. (Macv.); Glenfinnan (Carr. *cf.* Pears. Hep. Brit., p. 406).

Outer Hebrides.—Tarbert (West); Clisham, above 2000 ft. alt. (West).

Lower N. Highlands.—*W. Ross:* Glasven, Loch Carron, c. descending to 1500 ft. (Macv.). *W. Ross:* hill behind Achnasheen, alt. *ca.* 800 ft. (Macv.).

Upper N. Highlands.—*W. Sutherland:* Ben Clibreck above 2000 ft. alt. (Lillie). *Caithness:* Morven (Lillie).

Gymnomitrium corallioides *Nees*

Has only been found on a few of the higher mountains from Perthshire and West Inverness to Caithness. In the Breadalbane Hills it has been found from 2800 to 3200 ft. alt., but most probably occurs higher, and it has been found in Caithness at 2300 ft. alt. Occurs usually in large greenish-white to white masses on boulders. Fruit is rather common.

S.E. Highlands.—*Mid Perth:* Ben Laoigh, 1883 (Ewing); Ben Lawers (Ewing); do., f. from 2800–3200 ft. alt. (Macv.); Craig Chailleach (Ewing); King's Seat nr. summit (D. C. Jones).

Mid E. Highlands.—*S. Aberdeen:* Lochnagar, 1856 (Croall *cf.* Carr. Brit. Hep., p. 8); Corrie Ceandor (West).

W. Highlands.—*W. Inverness:* Ben Nevis, 1830 (Grev. *cf.* Carr. Brit. Hep., p. 8); Roshven, Moidart, alt. 2800 ft. (Macv.).

Upper N. Highlands.—*W. Sutherland:* Sutherland mountains, 1830 (Grev. *cf.* Carr. Brit. Hep., p. 8). *Caithness:* Morven, 2300 ft. alt. (Lillie).

GYMNOMITRIUM CRENULATUM *Gottsche*

Almost confined to the west side of the country, where it is frequently common. In the West Lowlands it is found in some quantity on the Kells Hills in Kirkcudbright, descending to 1000 ft. alt. It has not been found in the East Lowlands. In the East Highlands it is very rare except near the western boundary. It has been found in one or two localities in Forfar and Aberdeen, but not in North Perth, and is very rare on the Breadalbane range. It is common in the West Highlands and in the hilly districts of the Hebrides. On the west coast it descends to sea-level in a few localities, and is rather frequently seen at an altitude of about 200 ft., but is generally uncommon below 700–900 ft. alt. It does not usually occur below 1300–1400 ft. alt. when at any distance from the coast. It has not been recorded above 2500 ft. alt. It is uncommon in the North Highlands and has not been found in Shetland. Fruit, which matures from June to August, is frequent and sometimes common.

S.W. LOWLANDS.—*Kirkcudbright:* Milyea, New Galloway (M'And.); Black Craig, New Galloway, alt. *ca.* 1000 ft. (M'And.).

S.E. HIGHLANDS.—*Mid Perth:* Craig Chailleach (Ewing); Ben Laoigh, alt. 2400 ft., R. (Macv.); Ben Chuirm, alt. 1400 ft., R. (Macv.); Ben Dubh Craige, cfr. alt. *ca.* 2200 ft., R. (Macv.); Coire Ardran, C. (Macv.).

MID E. HIGHLANDS.—*Forfar:* Camlochan (Ew. and Young). *S. Aberdeen:* Glen Beg, Braemar (Stabl.); Corrie Ceandor (West).

W. HIGHLANDS.—*Clyde Isles:* Cairn na Cailleach, Arran, F. descending to 900 ft. (Macv.). *Dumbarton:* Ben Vorlich, C. (Macv.); Allt Dubh Uisgue, alt. *ca.* 150 ft. (Macv.). *Argyll:* Glencoe, alt. 1000 ft. (Macv.); Coire Ghlais, Ben Cruachan, R. (Macv.); Coire Creachainn, Ben Cruachan, C. from 1400–1900 ft. alt. (Macv.); Ben Udlaidh, on a few rocks at 2300 ft. alt. (Macv.); Ben an Dothaidh, U. (Ewing and Macv.); Ben Arthur, 1300–1900 ft., F. (Macv.); Glen Ure (Kenn.). *W. Inverness:* Laggan, alt. 2000 ft., 1879 (Ferg.); Ben Nevis, R.C. (Macv.); Glen Nevis, C. from

150–700 ft. (Macv.); Moidart, F. from 700–2500 ft. alt. and descending to sea-level (Macv.); Ardnamurchan, nr. Salen, alt. *ca.* 200 ft. (Macv.).

Inner Hebrides.—*Mid Inner Hebrides:* Ben More (Ewing). *N. Inner Hebrides:* Loch Coruisk, 1871 (Barker); Glen Sligachan (Barker); Ben Cailleach, Broadford, v.c. from 700–1600 ft. (Macv.).

Outer Hebrides.—Nr. Tarbert (West); Clisham, above 2000 ft. alt. (West).

Lower N. Highlands.—*W. Ross:* Loch Carron hills, U. descending to 1500 ft. (Macv.).

Upper N. Highlands.—*Caithness:* Morven with *G. obtusum* (Lillie).

Orkney.—Summit of Ward Hill, Hoy (Lillie).

Gymnomitrium varians (*Lindb.*) *Schiffn.*
Sarc. confertus Limpr.

Is frequent on several of the highest hills, occurring in abundance in some places on Ben Lawers and Ben Nevis. It occurs as large dark-brown, more rarely reddish, patches on bare soil: occasionally as scattered stems among mosses, from 2800 ft. to 4400 ft. alt. Fruit is common and is mature from June to August.

S.E. Highlands.—*Mid Perth:* Ben Lawers, F. from 2800–3400 ft. alt., cfr. (Macv.); Am Binnean, cfr. (Young); Ben Laoigh (Macv.).

Mid E. Highlands.—*Forfar:* Camlochan (Ewing and Young).

N.E. Highlands.—*E. Inverness:* Mam Soul (Cocks).

W. Highlands.—*W. Inverness:* Ben Nevis, alt. 4000 ft. 1880 (West); do., F. from 3600–4400 ft. alt., also C. with fr. (Macv.).

Gymnomitrium crassifolium *Carr.*

A rare species confined to a few of the higher hills. Is much rarer than *G. varians* and grows in similar places, and with much the same appearance. It ascends to the summit of Ben Nevis at 4400 ft. alt., and descends to about 3000 ft. alt. on Ben Lawers. Fruit is less common than in *G. varians*.

S.E. Highlands.—*Mid Perth:* Ben Lawers, 1878 (C. J. Wild); do., alt. 3900 ft., cfr. (Macv.); do. (G. Davies).

Mid E. Highlands.—*S. Aberdeen:* Craig Choinneach (A. O. Black *cf.* Trans. Bot. Soc. Ed., xiii. 1879); Ben MacDhui (Stabl.); Braeriach, alt. 3400 ft. (J. A. Wheldon).

N.E. Highlands.—*E. Inverness:* Braeriach, alt. 3300 ft. (A. Wilson and J. A. Wheldon).

W. Highlands.—*W. Inverness:* Ben Nevis, 1880 (West); do., 1909 (H. H. Knight).

Gymnomitrium adustum *Nees*
Marsupella olivacea Spruce

Frequent on many of the hills in the Highlands to at least 3600 ft. alt., and also occurring, though rarely, in the lower subalpine regions to sea-level. It has only as yet been found in one locality in the Southern Uplands. When on the low ground of the subalpine region and for some distance up the hills, this plant is generally found on rocks and boulders as small loose tufts of an olive-green or yellowish-brown colour. On the higher parts of the hills the plant is most commonly found on bare soil, generally in rather compact, nearly black patches. Although this species is not rare on schistose rocks, it is found most commonly on granite, and has also been found on basalt. Fruit is generally present throughout summer and autumn.

N.W. Lowlands.—*Lanark:* Green Lowther, on crumbling rock, alt. 2100 ft., cfr. (Macv.).

S.E. Highlands.—*Mid Perth:* Ben Lawers, alt. 2900 ft., cfr. (Macv.); Ben Laoigh, alt. 2100–2500 ft., cfr. (Macv.). *N. Perth:* Glen Thaitneich, cfr. 1879 (Ferg.); Glas Meol, cfr. (Ewing and Young).

Mid E. Highlands.—*S. Aberdeen:* Lochnagar, cfr., 1876 (Sim); Coire Ceanmor, cfr. (Ewing and Young); Meal Odhar (Ewing and Young).

W. Highlands.—*Dumbarton:* Ben Vorlich, alt. 1900 ft. (Macv.). *Argyll:* Coire Ghlais, Ben Cruachan, on several rocks, cfr. (Macv.); Coire Creachainn, Ben Cruachan, alt. 1700–1900 ft., cfr. f. (Macv.); Ben an Dothaidh, on boulders, alt. *cc.* 1800 ft. (Ew. and Macv.); Ben Arthur, on boulders, alt. 1900 ft., cfr. (Macv.). *W. Inverness:* Moidart, sea-level,

cfr. (Macv.); Scuir Donald, alt. 1500 ft. (Macv.); Glen Nevis, alt. *ca.* 1000 ft. (Macv.); Ben Nevis, N. side, c. at 2300 ft. alt., cfr. (Macv.); Glen Nevis on bank, alt. 200 ft., cfr. (Macv.).

Gymnomitrium alpinum (*Gottsche*) *Schiffn.*

Sarc. alpinus Gottsche

A rare species, but frequent in the granite districts, especially on the west side of the country, and on some of these hills it is rather common. It occurs also on porphyritic and schistose rocks, though much less frequently, and rarely in any quantity. In the West Lowlands it descends to about 1200 ft. alt., and to sea-level in one locality in the West Highlands, but is rarely seen below 1400 ft. alt. It ascends to 3500 ft. alt. in the East Highlands and to 4300 ft. on Ben Nevis, but is seldom seen above 2500 ft. alt. on the western side of the country.

It grows in compact, or more generally loose, tufts of a dark-brown colour on rather dry rocks and boulders. Male and female plants are common, both sometimes occurring in the same tuft, but fruit has not been found.

Carrington's *Nardia Funckii* var. *robustior*, described in his *Brit. Hep.*, p. 19, is *Gymn. alpinum*, as Sim's specimen shows; but it is probably also in part *Mars. sparsifolia* and *M. Sullivanti*, both of which Sim also collected at the same time, and which are also labelled *Nardia Funckii* in his Herbarium.

S.W. Lowlands.—*Kirkcudbright:* Black Craig, New Galloway, alt. *ca.* 1200 ft. (M'And.); Ben-y-Guinea (M'And.).

S.E. Highlands.—*Mid Perth:* Craig-an-Lochain, Killin (Ewing); Ben Laoigh, alt. *ca.* 2400 ft. (Macv.). *N. Perth:* Glen Thulachan, alt. 3200 ft. (Ferg.); Ben Gulabin (Ewing and Young).

Mid E. Highlands.—*Kincardine:* Crags above Tillylair (Sim). *S. Aberdeen:* Loch Ceandor (G. E. Hunt *cf.* Carr. Brit. Hep., p. 14); Ben MacDhui (Croall *cf.* Carr. Brit. Hep., p. 14); do., alt. 3500 ft. (West); Lochnagar, 1873 (Ferg.).

W. Highlands.—*Argyll:* Coire Gabhail, Glencoe, alt. 1000 ft. (Macv.); nr. head of Loch Long, sea-level (Macv.); Ben Udlaidh, alt. 2200 ft. (Macv.); Coire Creachainn, Ben

Cruachan, R.C. from 1400–2000 ft. alt. (Macv.); Ben Arthur, 1900 ft. alt., F. (Macv.). *W. Inverness:* Ben Nevis, alt. 2300 ft. (Macv.); do., 4300 ft. alt. (J. B. Duncan and H. H. Knight); Coire Dheirg, Glen Nevis, alt. *ca.* 2000 ft. (Macv.).

MARSUPELLA Dum.

Marsupella condensata (*Ängstr.*) *Kaal.*

Almost confined, so far as yet known, to Ben Lawers, where it occurs on moist soil from 3200 ft. alt. upwards. Forms rather extensive brown patches on the bare soil in similar places to which are found *Conostomum boreale* and various small species of *Marsupella* and *Gymnomitrium*. The Scottish plant is usually a more elongate form than is commonly found on the Continent.

S.E. Highlands.—*Mid Perth:* Ben Lawers, alt. 3200 ft. in quantity, per., 1901 (Macv.); Ben Lawers, 1907 (H. H. Knight); do., 1908 (W. G. Travis).

W. Highlands.—*W. Inverness:* Ben Nevis, *forma* 1908 (H. H. Knight).

Marsupella nevicensis (*Carr.*) *Kaal.*

Sarc. capillaris Limpr.

Whitehead's locality on Ben Nevis is the only known station for this species in Scotland. Here it is very rare and confined to one series of rocks between 3000 and 4000 ft. alt. The rocks are very wet, the plant being nearly confined to their vertical faces. It grows in thin light-green patches unmixed or with an alga when in the wet places, or in small brown tufts on rather drier parts among *Scapania undulata*. Female bracts were present on the specimens gathered by the author in July 1907.

W. Highlands.—*W. Inverness:* Ben Nevis, 1875 (J. Whitehead), on "dripping rocks near the summit"; do., ♀, 1907 (Macv.).

Marsupella Boeckii (*Aust.*) *Lindb.*

M. Stableri Spruce

Has only been found in a few places, chiefly on granite, from 1400 ft. alt. in West Inverness to 3600 ft. on Ben

Nevis. It occurs as thin purple patches on steep wet rocks. Male plants are common; fruit has not been observed.

Herr Kaalaas agrees that the Ben Nevis plant is certainly *M. Boeckii*. I cannot see that it differs from our *M. Stableri*. Mr Pearson, to whom I sent specimens from Ben Nevis, also had no doubt that they were the same species as *M. Stableri*.

Mid E. Highlands.—*S. Aberdeen:* Ben MacDhui, 1884 (Stabl.).

W. Highlands.—*Argyll:* Coire Creachainn, Ben Cruachan, on several boulders, alt. 1800–1900 ft. (Macv.); Ben Arthur with *Gymn. alpinum*, alt. 1900 ft., r. (Macv.); Ben Doureann (H. H. Knight). *W. Inverness:* Moidart, alt. 1400 ft. (Macv. and Pears.); Ben Nevis, N. side, alt. 2300 ft., r. (Macv.); nr. Red Burn, Ben Nevis, alt. 2600–3600 ft. (Macv.).

Marsupella ustulata *Spruce*

Frequent in many parts of the Highlands, from sea-level on the west coast to 3900 ft. alt. in Mid Perth. Grows in small, compact, dark-brown to nearly black patches on soil, also as scattered patches on boulders and rocks, especially on schist and granite. It doubtless occurs in many other parts of the Highlands than those recorded, also in the hilly district of Kirkcudbright, but has been overlooked. It is of similar appearance to *M. Sprucei*, and cannot be distinguished from it in the field. Fruit is usually present from June to October.

S.E. Highlands.—*Mid Perth:* Ben Lawers, alt. 2700–3900 ft., cfr. (Macv.); Craig-an-Lochain, alt. 2000 ft., cfr. (Macv.); Achrioch nr. Tyndrum, alt. 800 ft. cfr. (Macv.); Ben Dubh Craige (Macv.); Ben Heasgarnich, cfr. (Young).

Mid E. Highlands.—*Forfar*: Nr. Loch Brandy, 1876 (Ferg.).

N.E. Highlands.—*E. Inverness:* Cairn Gorm, alt. 3200 ft., cfr. (Macv.).

W. Highlands.—*Kintyre:* Nr. Lochgilphead, cfr. (Ewing). *Argyll:* Bank by roadside, Lochan Bhe, cfr. (Macv.). *W. Inverness:* Moidart, in several places near

sea-level (Macv.): Ben Nevis (Macv.): Coire nam Feusgam, Glen Nevis, cfr. (W. E. Nicholson).

Marsupella Sprucei (*Limpr.*) *Bernet*

Known as yet only in a few localities from sea-level on the west coast to 2600 ft. alt. in Mid Perth. Occurs on peaty soil and on rocks in dark-brown patches sometimes of considerable extent. Fruit is usually present, and has been noted from May to October.

S.E. Highlands.—*Mid Perth:* Ben Laoigh, alt. 2600 ft., on soil, cfr. (Macv.).

Mid E. Highlands.—*S. Aberdeen:* Meol Odhar (Ew. and Young).

W. Highlands.—*Argyll:* Banks by roadside nr. Bridge of Orchy, cfr. (Macv.). *W. Inverness:* Scardoise, Moidart, nr. sea-level, 1899 (Macv.).

Marsupella Funckii (*Web. et Mohr*) *Dum.*

This is an uncommon species in Scotland. It is rare in the West Lowlands, very rare or absent in the East Lowlands, and it has not been found in Fife or near the east coast of the Highlands except in one locality. It appears to be absent in the extreme north. It has been found in various localities in the inland parts of the East Highlands, and in several parts of the western districts of the Highlands. It is more frequent in the latter district than elsewhere, and has been found in quantity in some places. It is a low-ground plant, rarely occurring above 1000 ft. alt., and preferring our milder districts. It has been recorded as having been found on some of our higher mountains, but the author has never met with it or seen a specimen from any of them. The species has been greatly confused with other alpine species of similar habit. Carrington, in *Brit. Hep.*, p. 17 and 19, has *Nardia Funckii* var. *robustior* from Lochnagar, 1873, leg. J. Sim. This specimen was gathered by the Rev. J. Fergusson, and was sent by Sim to Carrington, who named it *Nardia Funckii*. The plant is, however, *Gymnomitrium alpinum*. There are two other packets from Lochnagar gathered by J. and T. Sim in 1876, labelled *Nardia Funckii*, one being *Gymn.*

alpinum, the other containing *Mars. sparsifolia* and *M. Sullivanti*. *Mars. Funckii* grows in large dark-brown or dark-green flat patches, nearly always on disused roads on soil among stones and rocks. Fruit is rather common in the West Highlands from March till June.

S.W. Lowlands. — *Kirkcudbright:* New Galloway (M'And.).

S.E. Highlands.—*Mid Perth:* Kiltyrie nr. Killin, on disused road (Macv.); Ben Ghlas, alt. 1000 ft. (Macv.); roadside at Lochan-a-Larige (Macv.); Auchlyne (Ewing).

Mid E. Highlands.—*Forfar:* Glen Fee, 1876 (Ferg.). *Kincardine:* Garol (Sim).

N.E. Highlands. — *E. Inverness:* Laggantigown nr. Aviemore, on old road (Macv.).

W. Highlands. — *Kintyre:* Tarbert (Ewing). *Clyde Isles:* Loch Ranza, old roadside (Macv.); Lamlash (M'And.). *Dumbarton:* Ardlui, roadside (Macv.). *W. Stirling:* Inversnaid, on footpath (Macv.). *Argyll:* Nr. Loch Awe Station, roadside, v. (Macv.); L. Tulla, roadside (Macv.). *W. Inverness:* Moidart, stony footpaths, c. (Macv.); Glen Nevis, roadside (Macv.).

Inner Hebrides.—*Mid Inner Hebrides:* Between Dervaig and Achnadrish, roadside (Macv.).

Lower N. Highlands.—*W. Ross:* Strathcarron, roadside, r. (Macv.).

Marsupella sparsifolia *Lindb.*

The only known locality in Scotland for this species is on the granite of Lochnagar. Sim's specimen in the author's possession is named *Nardia Funckii* and contains two species, viz. the present paroicous plant and the dioicous *Mars. Sullivanti*.

Mid E. Highlands.—*S. Aberdeen:* Lochnagar, per., 1876 (J. and T. Sim).

Marsupella sphacelata (*Gies.*) *Lindb.*

Is only known from the Eastern Grampians. Forms flaccid dark-green swelling tufts, either submerged in streams or on very wet ground.

Mid E. Highlands.—*S. Aberdeen:* Ben MacDhui, 1868 (G. E. Hunt *cf.* Carr. Brit. Hep., p. 12); Loch Ceandor (G. E. Hunt, *loc. cit.*); Ben MacDhui, 1876 (Whitehead).

Marsupella Sullivanti (*De Not.*) *Evans*
M. erythrorhiza (Limpr.) Schiffn.

Has only been found in a few localities, but is doubtless widely distributed in the Highlands, though uncommon. Occurs on the lower slopes of the hills from 1000 ft., and ascends to 3600 ft. alt., and is found at sea-level in Shetland. Forms dark reddish-brown to nearly black patches. In low altitudes it occurs on moist peaty ground, and in high altitudes it is found in stony, marshy places. Perianths are frequent.

S.E. Highlands.—*Mid Perth:* Killin Hills, 1885 (Ewing); moorland nr. Ben Chuirm (Young); Ben Heasgarnich (Ewing).

Mid E. Highlands.—*S. Aberdeen:* Lochnagar, 1876 (Sim); Ben MacDhui, 1882 (West); Peter's Hill (Sim).

N.E. Highlands.—*E. Inverness:* Mam Soul, per. (Cocks).

W. Highlands.—*Argyll:* Ben Arthur, alt. 1400 ft. (Macv.). *W. Inverness:* Ben Nevis, alt. 3600 ft. (Macv.).

Outer Hebrides.—Benbecula (West).

Shetland.—Whiteness, 1878 (Sim).

Marsupella Jörgensenii *Schiffn.*

Known only as yet in a few localities from Kirkcudbright to Perthshire and W. Inverness, but is probably not very rare. It occurs usually in wet stony, peaty ground on the lower slopes of the hills, and is of similar appearance to *M. Sullivanti*. Perianths are frequent.

S.W. Lowlands.—*Kirkcudbright:* Nr. Loch Trool, alt. *ca.* 450 ft. (Macv.).

S.E. Highlands.—*Mid Perth:* Ben Odhar, alt. 1200 ft. (Macv.); Meal Ghaordie (Ewing).

N.E. Highlands.—*E. Inverness:* Craigellachie, Aviemore, per. (Macv.).

W. Highlands.—*Argyll:* Nr. Loch Tulla, in peat-moss, alt. *ca.* 600 ft. (Macv.). *W. Inverness:* Ben Gaire, Moidart, alt. 1900 ft., 1899 (Macv.).

Marsupella emarginata (*Ehrh.*) *Dum.*

Generally distributed above the agricultural region from Dumfries to Shetland. It is rare in the low-lying districts of the Lowlands and East Highlands. In the former the typical plant hardly occurs below the subalpine region and is rare in many of its subalpine districts. This is the case over a large part of the Southern Uplands, where the rock is comparatively seldom exposed on the surface. On the granite hills of Kirkcudbright, and locally in a few other parts of the Uplands where the rock is exposed, the typical plant is common, but generally speaking the plant is confined to soil and is found as a small form with the leaf-lobes rather acute. Over most of the subalpine region of the Lowlands it is absent, but is found in various detached rocky places with other subalpine species down, though rarely, to sea-level. In the mountainous districts over all the Highlands the plant is abundant from sea-level, and ascends to 3500 ft. alt. in the centre of Scotland and to 3600 ft. alt. on Ben Nevis. Although the typical plant usually occurs only on rocks, it is also found on soil in the West Highlands, but the usual form on soil over the Highlands is the small, rather acute-lobed plant.

This species occurs on all our formations, but is uncommon on limestone and on sandstone. Grows in dark-green to reddish patches, which are often of considerable extent, on moist or wet rocks, but rarely on rocks which are constantly wet. The red colour is mostly assumed when on granite and gneiss; when on soil the plant is frequently nearly black. Fruit is common, and is mature from February to July.

S.W. Lowlands.—*Dumfries:* Hartfell, 1880 (A. M'K. in Herb. Croall); Crichope Linn (Macv.); Sanquhar district, U. (Macv.). *Kirkcudbright:* Criffel, 1840 (Cruicks.); New Galloway (M'And.); Merrick (J. Murr.); Glen Trool (Macv.); Penkill Burn (Macv.). *Wigtown:* Knowe (Ewing); nr. New Luce (Ewing).

N.W. Lowlands.—*Ayr:* Largs (Ewing); W. of Loch Doon (West); above Ladyland (Scott). *Renfrew:* Lochwinnoch (Ewing); Loch Thom (Ewing); Cloch (Ewing); Misty Law (Scott). *Lanark:* Elvanfoot district, V.R. (Macv.).

E. Lowlands.—*Peebles:* Cowie's Linn (A. Murr.); Carton Burn (Macv.); Logan Water, v.r. (Macv.); Dreva, r. (Macv.); Talla Water, r.c. (Macv.). *Berwick:* Tullishill, on old road (Evans). *Haddington:* Lammer Law, on road, etc. (Evans); above Gifford, on road (Evans); Gullane Links (M'And.); Traprain Law (Evans). *Edinburgh:* Corstorphine Hill (M'And.); Nether Habbie's Howe, cfr. (Evans); Newbattle Abbey (Evans); Loganlee, on old road (Evans); Torduff Reservoir (Evans). *Linlithgow:* Craigiehall Wood (M'And.).

S.E. Highlands.—*Fife and Kinross:* Drumcarro Crag (How.); Lomonds (How.); Kinghorn (Evans); Duncarn Hill (Young); nr. Falkland (Evans); Glen Queich (Evans). *E. Stirling:* King's Park, Stirling (Croall); Boquhan Glen (K. & S.); Barton Burn, Touch (K. & S.). *S. Perth:* Ben Ledi, 1841 (Gard.); Menstrie Glen (Croall); Loch Ard (Evans); Am Binnean, alt. *ca.* 3500 ft. (Evans); Trossachs (Ewing); Strathyre, v. (Macv.). *Mid Perth:* Ben Lawers (Grev.); do., 1842 (Gard.); do., c. to 3200 ft. alt. (Macv.); Killin district, c. (Macv.); Ben Heasgarnich (West); Tyndrum district, c. (Macv.). *N. Perth:* Glas Thalachan, 3400 ft. (Ferg.); Glen Shee (Ferg.); Carn Mohr, Glen Shee (Ewing); Glen Beg, Glen Shee (Ewing and Young); Persie (Barker).

Mid E. Highlands.—*Forfar:* Clova Mountains, 1824 (Grev.); Camlochan, 1843 (Gard.); foot of Glenesk (Croall); ravine of the Mourine (Croall); Glen Dole (Barker); Den of Airlie (Ferg.); Craig's Wood, nr. Montrose (Croall); Sidlaws (Aimer). *Kincardine:* Mount Shade (Sim); Dalfro Hill (Sim); Den of Garol (Sim); Kerlock (Sim); Tillylair (Sim). *S. Aberdeen:* Craig Choinnich, 1843 (Gard.); Dhu Loch (Dickie); Braemar, cfr. (Croall); Ben Avon (Croall); Lochnagar (Sim); Glen Beg, Balmoral (Stabl.); Coire Ceanmor (West).

N.E. Highlands.—*Banff:* Loch Builg, 1840 (Dickie). *Elgin:* Rafford Burn, 1848 (Croall); banks of the Findhorn (Croall). *E. Inverness:* Kilravock Wood, Nairn, 1846 (Croall); Cairn Gorm (Macv.); nr. Aviemore, etc. (Macv.); Mam Soul (How.); Glen Tromie, cfr. (Miss Macv.); Fort Augustus (Macv.).

W. Highlands.—*Kintyre:* Ardrishaig (Ewing); Camp-

beltown (Ewing). *Clyde Isles:* Loch Ranza, C. (Macv.). *Dumbarton:* Ben Vorlich, V.C. (Macv.); Arrochar, R.C. (Macv.); Loch Humphrey (Ewing); Tarbert (Macv.). *W. Stirling:* Nr. Killearn (K. & S.); Inversnaid (K. & S.). *Argyll:* Benmore, Holy Loch, many places (A. Murr.); head of Loch Long (Macv.); Ben Arthur (Macv.); Glencoe (Macv.); Ballachulish (Macv.); Glen Nant, R.C. (Macv.); Loch Awe district, C. (Macv.); Ben Cruachan, V.C. (Macv.); Ben Udlaidh, C. (Macv.); Ben Doureann, C. (Macv.); Ben an Dothaidh, C. (Macv.); Glen Lochy (Macv.). *W. Inverness:* Moidart, V.C. (Macv.); Ardnamurchan, V.C. (Macv.); Sunart, V.C. (Macv.); Glen Nevis (Macv.); Ben Nevis, C. (Macv.); do., to alt. 3600 ft. (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Jura (Ewing); Loch nam Breac, Islay (Gilm.); Ardtalla Glen, Islay (Gilm.). *Mid Inner Hebrides:* Ben More (Ewing); Tobermory, V. (Macv.); Allt na Searmoin (Kenn.). *N. Inner Hebrides:* Sligachan (Ewing); Broadford district, L.C. (Macv.).

Outer Hebrides. — Barra (Ewing); Tarbert, several places (West); Clisham (West).

Lower N. Highlands. — *W. Ross:* Ben Slioch, 1867 (How. and Jenner); Ben Eay, 1868 (How.); Balloch nam Bo (How.); Strathcarron, L.C. (Macv.); Gairloch (Miss Macv.). *E. Ross:* Ben Wyvis (How.); Achnasheen, C. (Macv.); Loch Luichart (West); Strathpeffer (M'In.).

Upper N. Highlands. — *E. Sutherland:* Strath Ullie (Lillie). *E. Sutherland:* Ben Clibreck, C. (Lillie); Ben Laoghal (Lillie). *Caithness:* Dunbeath Strath (Lillie); Dirlot (Lillie); nr. Achkinloch (Lillie); Langwell (Lillie).

Orkney.—Stromness (West).

Shetland.—Whiteness (Sim); Busta (Sim).

var. minor *Carr.*

N.E. Lowlands.—*Renfrew:* Roadside, Garvocks Moor (W. E. Nicholson).

S.E. Highlands.—*Mid Perth:* Ben Lawers (Macv.).

W. Highlands.—*Dumbarton:* Arrochar, cfr. (Macv.). *W. Stirling:* Inversnaid (Macv.). *Argyll:* Ben Cruachan (Macv.); Ben Doureann (Macv.). *W. Inverness:* Moidart (Macv.).

Marsupella Pearsoni *Schiffn. MS.*

The distribution of this recent segregate is not well known yet. It has been found from the southern part of Argyll to Shetland. It usually grows on the lower slopes of the hills on flat rocks in marshy ground, these rocks being constantly wet and frequently submerged by running water from the overflowing rills. On this account the leaves are generally partially destroyed, few being entire. It appears to be uncommon in the higher parts of the hills, but has been found up to 2800 ft. alt. Forms rather extensive dark-green to reddish-brown patches. Fruit has not been observed.

S.E. Highlands.—*Mid Perth:* Ben Lawers, 1900 (Macv.).

N.E. Highlands.—*E. Inverness:* Braeriach, alt. 2800 ft. (Wilson and Wheldon).

W. Highlands.—*Dumbarton:* Arrochar, alt. *ca.* 150 ft. (Macv.). *Argyll:* Kilmun Hills, 1904 (Scott); Ben Arthur, alt. *ca.* 200 ft. (Macv.); Ben Fhada, Glencoe (West). *W. Inverness:* Glen Nevis, alt. *ca.* 400 ft. (Macv.).

Inner Hebrides.—*Mid Inner Hebrides:* Ben More (Kenn.).

Shetland.—E. side of Bergs of Skelbery, alt. *ca.* 500 ft. (Beeby).

Marsupella aquatica (*Lindenb.*) *Schiffn.*

Widely distributed in the subalpine region from Wigtown to Shetland, and ascending into the alpine region of the Highlands to 3500 ft. alt. at least. It is rare in both West and East Lowlands, though frequent in the Kirkcudbright hills and in the Talla district of the Tweed. It descends in the Lowlands to 300 ft. alt. on the west side of the country, and to about 900 ft. on the east. It has not been found in Fife, nor near the coast of the East Highlands, with the exception of what appears to be a well-marked subalpine region near the junction of Kincardine and Aberdeen. Through the hilly districts of the entire Highlands it is doubtless a common species, though few specimens have been noted from the North Highlands. Among the hills of the East and West Highlands and

Islands it is common, descending to sea-level on the west coast from the Clyde northwards.

This species is common on schistose rocks, granite, and various volcanic rocks. Forms large, usually erect, dark-green masses on submerged rocks in streams, or where there is a constant trickle of water. It is also sometimes found submerged at the margin of Highland lochs. Perianths and male plants are common; fruit is frequent.

S.W. Lowlands. — *Kirkcudbright:* Knockindoch Hill (Scott); Merrick (J. Murr.); Tannoch (M'And.); Glen Trool (Macv.). *Wigtown:* Knowe (Ewing).

N.W. Lowlands.—*Renfrew:* Glen, Misty Law (Scott).

E. Lowlands.—*Peebles:* Talla W., f. above alt. 950 ft. (Macv.). *Edinburgh:* Nether Habbie's Howe (Evans); Gutterford Burn (Evans).

S.E. Highlands.—*S. Perth:* Ben Aan (West); Trossachs (Ewing); Tillicoultry Glen (Evans). *Mid Perth:* Ben Laoigh (Ewing); do., c. (Macv.); Ben Dubh Craige, v.c. (Macv.); Ben Odhar, c. (Macv.); Am Binnean (Ewing); Killin (J. Hunter); King's Seat, Killin (Evans). *N. Perth:* Glas Thulachan (Ewing).

Mid E. Highlands.—*Forfar:* Foot of Glenesk (Croall); Camlochan (Ferg.); Clova (Aimer). *Kincardine:* Strachan Sim); Dalfro (Sim). *S. Aberdeen:* Lochnagar (Sim); Corrie Ceandor (West); Peter's Hill (Sim).

N.E. Highlands.—*E. Inverness:* Mam Soul (Cocks); Invercannich (Cocks); Kincraig (Miss Macv.); Glen Tromie (Miss Macv.); Braeriach (A. Wilson and J. A. Wheldon).

W. Highlands.—*Clyde Isles:* Shant Hill (Campb.); Arran (Ewing); Loch Ranza, c. (Macv.); Benlister Glen (M'And.). *Dumbarton:* Tarbert (Macv.). *Argyll:* Ben Cruachan (Croall); Ben Udlaidh (Macv.); Ballachulish (Macv.); Ben Fhada, Glencoe (West); Ben Doureann, c. (Macv.); Ben an Dothaidh, c. (Macv.); Glen Lochy (Macv.); Kentallen (Macv.); Ben Arthur, v.c., 400 to 2600 ft. (Macv.). Puck's Glen (A. Murr.). *W. Inverness:* Ben Nevis, 1875 (Whitehead); Glen Nevis (Macv.); Choir Arder, alt. 3500 ft. (Ferg.); Moidart, c. (Macv.); Ardnamurchan, c. (Macv.); Sunart, c. (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Loch nam Breac, Islay (Gilm.). *Mid Inner Hebrides:* Ben More (Kenn.). *N. Inner Hebrides:* Loch Coruisk (Barker); Ben Cailleach (Macv.).

Outer Hebrides.—Barra (Ewing); Balallan (West).

Lower N. Highlands.—*E. Ross:* Without further locality, 1872 (Barker).

Upper N. Highlands.—*W. Sutherland:* Ben Clibreck (Lillie). *Caithness:* Ousdale (Lillie).

Orkney.—Hoy (Lillie).

Shetland.—Mavisgrind (Sim); Unst (Sim).

NARDIA S. F. Gray

Nardia compressa (*Hook.*) *Gray*

Alicularia compressa (Hook.) Nees

Is found from Kirkcudbright to Shetland, but is an uncommon species. It prefers granite districts, but occurs also on schistose rocks. It is found locally in quantity on granite in some of the hilly districts of Kirkcudbright, but has not been found elsewhere in the Lowlands. In the East Highlands it is more frequent in the Cairngorm Mountains than in other parts. It is stated by Mr G. West to be "a common species at the side of lochs over the whole hill district of the Loch Ness area," the rocks being schistose. It is rare in Perthshire and the West Highlands, though occurring in some quantity on the granite of Arran and Ben Cruachan. Is very rare in the Inner Hebrides, and has not been found in the Outer Hebrides. Is very rare in the North Highlands, and has not been found in the extreme north of the mainland. It has not a particularly western distribution in Scotland, as it is stated to have in Norway, but this may be due in part to the greater prevalence of granite on the eastern side. It is found from near sea-level in the West Highlands, and from 400 to 500 ft. alt. in the Lowlands, and ascends to 2800 ft. in the East Highlands. Grows in dark-green to purple spongy masses on submerged rocks in streams, more rarely at the side of lochs. In the latter habitat it appears to be depauperate.

Fruit has not been found in Scotland, but this may be

partly due to the probably early time of the year when fruiting occurs. The male plant is common; the female appears to be rarer and to occur seldom in the same tuft with the former.

S.W. Lowlands.—*Kirkcudbright:* Cairn Edward, alt. *ca.* 600 ft. (M'And.); Corserine (West); Glen Trool, alt. *ca.* 300 ft. (Macv.); Mulwharchar, alt. 2000 ft. (G. West).

S.E. Highlands.—*Mid Perth:* Ben Laoigh (T. Rogers *cf.* Pears. Hep. Brit., p. 370); Creag Mhor (Ewing); Ben Odhar, several places, f. to 2000 ft. (Macv.); Am Binnean (Ewing).

Mid E. Highlands.—*Forfar:* Camlochan (Whitehead). *S. Aberdeen:* Glen Clunie (Whitehead *cf.* Pears. Hep. Brit., p. 370); Lochnagar (Sim); Ben MacDhui (G. E. Hunt); do. (Stabl.).

N.E. Highlands.—*E. Inverness:* Mam Soul (Cocks); Loch in Balmacaan Forest (G. West); Loch in Carn a Chuilinn (G. West); Braeriach, alt. 2800 ft. (G. Wilson and J. A. Wheldon).

W. Highlands.—*Clyde Isles:* Goatfell, 1839 (Dickie Herb.); Cairn na Cailleach, abundant, descending to 400 ft. (Macv.); Lamlash (M'And.). *Dumbarton:* Allt Dubh-Uisgue, Ardlui (Macv.). *Argyll:* Succoth Hill, Arrochar (A. M'Kinlay *cf.* Carr. Brit. Hep., p. 30); head of Glen Orchy (Ewing); Coire Creachainn, Ben Cruachan, f. (Macv.); Ben Fhada, Glencoe (West). *W. Inverness:* Moidart, 600 ft. alt., v.r. (Macv.); Allt Coire Dheirg, Glen Nevis, alt. 1200 ft. (Macv.).

Inner Hebrides.—*N. Inner Hebrides:* Sligachan (Miss Macv.).

Lower N. Highlands.—*W. Ross:* Ben Slioch (How. *cf.* Carr. Brit. Hep., p. 30); side of Loch Maree, 1867 (How.).

Orkney.—Hoy (Lillie).

Shetland.—E. side of Bergs of Skelberry, Northmaven, alt. *ca.* 500 ft. (Beeby).

Nardia scalaris (*Schrad.*) *Gray*

Alicularia scalaris (Schrad.) Corda

This species shares with *Diplophyllum albicans* and *Pellia epiphylla* the distinction of being the commonest

species in Scotland. Although it is rather uncommon in the region of cultivation in the Lowlands and east part of the country, it usually occurs in abundance in their sub-alpine regions and over the whole of the Highlands and Islands, extending to the summit of the hills to 4400 ft. alt. It is very rare, though occasionally occurring, on limestone; but, as this formation is uncommon in Scotland, it hardly affects its general distribution. It is found in almost every situation, except on trees; it frequently forms a carpet on gravelly footpaths in the Highlands, or covers turfy walls and banks. It is also common on wet ground on the hills, especially on rocks in streams, where it may form erect, compact, submerged green masses; such forms are sterile, but otherwise the species fruits in quantity from March to May.

Ben Lomond, 1822 (Grev.).

S.W. Lowlands. — *Dumfries:* Nr. Craigs, Dumfries (Cruicks.); Whitecombe, several places (Johns.); Moffat (Miss Macv.); Langholm (Ewing); Sanquhar district, R.U. (Macv.); Crichope (Macv.); Wanlockhead (Macv.). *Kirkcudbright:* New Galloway (M'And.); Screel Hill (A. Murr.); Glen Trool (Macv.); Portmark (G. West). *Wigtown:* Portpatrick (M'And.); Aldouran Glen, roadside (Macv.); Glenluce (Macv.); nr. Penningham (Macv.).

N.W. Lowlands.—*Ayr:* Ayrshire (Lyon); Largs, cfr. (Ewing); Fairlie (Ewing); Loch Doon (West); Glen Afton, F. (Macv.). *Renfrew:* Lochwinnoch (Ewing); Loch Thom (Ewing); Misty Law (Scott). *Lanark:* Hamilton (J. Murr.); Carstairs Moss (Macv.); Falls of Clyde (Ewing); Tinto, to summit (Macv.); Elvanfoot district, C. (Macv.); Leadhills and Green Lowther summit (C. Macv.).

E. Lowlands.—*Peebles:* West Linton (Evans); Medwyn Water (Evans); Carlops (Evans); Broughton (Macv.); Upper Tweed valley, C. (Macv.). *Selkirk:* Crossleugh Burn (Evans); Tushielaw (Evans); Bowhill (Evans); Lindean, roadside, C. (Macv.). *Roxburgh:* Linhope (Miss Macv.); Eildon Hill, 800–1300 ft., V.C. (Macv.). *Berwick:* Nr. Lammer Law (Evans); nr. Scenes Law (Evans); Longformacus (Miss Macv.). *Haddington:* Lammer Law, several places (Evans); Gifford (Evans); Salton Wood

(Evans); Yester Woods (Evans). *Edinburgh:* Roslin Glen, cfr. (A. Murr.); Balerno Moss (A. Murr.); do., R.C. (Macv.); Currie Moor (Evans); nr. Gladhouse, cfr. (Evans); Clubbiedean (M'And.); Ravelrig (Evans); Torduff (Evans); Baads (Ewing). *Linlithgow:* Nr. Kipps (Evans); Drumshoreland (Evans); Fauldhouse Moor, cfr. (Evans); Bathgate (Evans).

S.E. Highlands. — *Fife and Kinross:* Tents Muir (How.); Lomond Hills (Young); Kinghorn (M'And.); Glen Queich, cfr. (Evans); Isle of May (West). *E. Stirling:* Gargunnock, cfr. (K. & S.). *S. Perth:* Strathyre (Macv.); Ben Ledi (Meld.); Am Binnean, nr. summit (Evans); Aberfoyle, cfr. (Evans); Trossachs (Ewing). *Mid Perth:* Breadalbane (Grev. Herb.); Stuc-a-Croin, 1841 (Gard.); Ben Lawers, 1843 (Jacks.); do., v.c. to 4000 ft. (Macv.); Killin district, v.c. (Macv.); Tyndrum district, v.c. (Macv.); Ben Challum (Ewing); nr. Methven (Ferg.). *N. Perth:* Cochrage Hill (Ferg.); Glen Beg, Glen Shee, limestone (Ferg.); Meal Vain (Ferg.); Glas Thalachan, 3200 ft. (Ferg.); Dunkeld (M'In.); Stormontfield (Meld.).

Mid E. Highlands. — *Forfar:* The Burn, Forfar, cfr. (Croall); Glenogil (Ferg.); Sands of Barrie (Ferg.); Clova (Ferg.); Fern (Ferg.); Sidlaws (Aimer); Reeky Linn (Aimer). *Kincardine:* Kerloch (Sim); Dalfro (Sim); Mount Shade (Sim); Cairn o' Mound (Sim). *S. Aberdeen:* S. bank of Don, 1836 (Dickie); Hill of Fare (Dickie); Lochnagar (Croall); Braemar (Croall); Ben Avon (Croall); Ballochbuie (Michie); Corrie Ceanmor (West). *N. Aberdeen:* Mormond Hill (Ewing).

N.E. Highlands. — *Banff:* Tomintoul, many places (Miss Macv.). *Elgin:* Linn of the Shogle, 1848 (Croall); Glen Beg nr. Grantown (Miss Macv.); Lochan Dorb (Miss Macv.). *E. Inverness:* Kingussie (Ferg.); Cairn Gorm (Macv.); Druie river, cfr. (Macv.); Loch Vaa (Macv.); above Lochan Dorb, Nairn (Miss Macv.); Kincraig (Miss Macv.); Mam Soul (Cocks); Fort Augustus, C. (Macv.).

W. Highlands.—*Kintyre:* Tarbert (Ewing); Campbeltown (Ewing); nr. Lochgilphead (Ewing). *Clyde Isles:* Kyles of Bute (Ewing); Loch Ranza, v.c. (Macv.). *Dumbarton:* Ardlui, v.c. (Macv.); Loch Humphrey (West);

Arrochar, v.c. (Macv.); Tarbert (Macv.). *W. Stirling:* Inversnaid (K. & S.); Killearn (K. & S.); Campsie (Ewing). *Argyll:* Holy Loch district, many places (A. Murr.); nr. head of Loch Long (Macv.); Glencoe (Macv.); Glen Nant, c. (Macv.); Loch Awe district on low ground and hill, v.c. (Macv.); Ben Udlaidh, v.c. (Macv.); Sandbank (Ewing). *W. Inverness:* Moidart, v.c. (Macv.); Ardnamurchan, v.c. (Macv.); Sunart, v.c. (Macv.); Glen Nevis (Macv.); Ben Nevis, alt. 4400 ft. (J. B. Duncan and H. H. Knight); Spean Bridge (Miss Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Jura (Ewing); Ardtalla Glen, Islay, cfr. (Gilm.); Ardbeg, Islay (Gilm.); Kildalton (Ewing). *Mid Inner Hebrides:* Ben More (Ewing); Tobermory (Macv.); Dervaig (Macv.); Salen (Kenn). *N. Inner Hebrides:* Ben Cailleach, Broadford, c. (Macv.); Broadford district (Macv.); Sligachan, c. (Miss Macv.).

Outer Hebrides.—Barra (Ewing); Benbecula (Ewing); Tarbert, many places (West); Balallan, many places (West); centre of N. Uist (West).

Lower N. Highlands.—*W. Ross:* Ben Slioch (How.); Loch Carron, l.c. (Macv.); Kyle (Macv.); Gairloch (Miss Macv.); Loch Maree (Miss Macv.). *E. Ross:* Achnasheen (Macv.); Scuir na Lapaich (Cocks).

Upper N. Highlands.—*E. Sutherland:* Ben Griam Mohr (Lillie); Strath Ullie (Lillie). *W. Sutherland:* Strath Halladale (Lillie); Strath Naver (Lillie); Ben Clibreck (Lillie); Ben Laoghal (Lillie). *Caithness:* Lybster (Lillie); Langwell (Lillie); Dunnet Head (Lillie).

Orkney.—Hoy, many places (West); Stromness (West); Kirkwall (West).

Shetland.—Lerwick (Sim); Whiteness (Sim); Northmaven (Sim); Yell (Sim); Unst (Sim); do. (Beeby); Clousta, many places (Grieve); Bressay (West); Scalloway, many places (West); Tresta (Beeby); Fair Isle (Miss Skene); Whalsey (Lillie); Weisdale (Beeby).

var. distans *Carr.*

N.W. Lowlands.—*Ayr:* Ladyland (Scott).

S.E. Highlands.—*Mid Perth:* King's Seat, Killin, alt. *ca.* 2000 ft. (D. Haggart).

N.E. Highlands.—*E. Inverness:* Braeriach, alt. 2300 ft. (Wheldon and Wilson).

W. Highlands.—*Argyll:* Puck's Glen (A. Murr.).

Nardia minor (*Nees*) *Arnell*

Alicularia geoscypha De Not.

An uncommon species in Scotland, and which has only been found in a few scattered localities from Lanarkshire to W. Ross. The highest altitude at present known for the plant is 2500 ft. in Mid Perth, but it probably occurs considerably higher. It is found on old walls and banks on the low ground, in pale-green tufts, and on moist soil on the hills, where it often assumes a reddish-brown colour. Perianths are generally present, and fruit is frequent.

N.W. Lowlands.—*Lanark:* Falls of Clyde, cfr. (Young).

S.E. Highlands.—*Mid Perth:* Nr. Lochan Chait, Ben Lawers, 1862 (A. M'Kinlay *cf.* Carr. Brit. Hep., p. 27); Ben Laoigh, cfr. (West): Tyndrum, per. (Macv.): Craig Chailleach, per., alt. 2500 ft. (Macv.).

Mid E. Highlands.—*Forfar:* Camlochan, 1868 (G. E. Hunt *cf.* Carr. Brit. Hep., p. 27); Clova, per. (Ferg.).

W. Highlands.—*W. Inverness:* Moidart, sea-level, per. (Macv.).

Inner Hebrides.—*N. Inner Hebrides:* Sligachan (Miss Macv.).

Lower N. Highlands.—*W. Ross:* Gairloch (Miss Macv.).

Nardia Breidleri (*Limpr.*) *Lindb.*

Alicularia Breidleri Limpr.

This minute alpine species has been overlooked in Scotland until recent years. It is not very rare near the summits of some of our higher mountains, and will doubtless be found on many of them which have moist soil about the summit. At present it is only known from a few localities, and descending to about 3000 ft. alt. It forms small reddish patches, very commonly mixed with *Anthelia Juratzkana*. Fruit has not been found.

S.E. Highlands.—*Mid Perth:* Ben Lawers, alt. 3200 ft. to 4000 ft., per., with *Anthelia Juratzkana* and *Pleuro-*

clada albescens, etc., 1900 (Macv.); do., 1908 (H. H. Knight); Cairn Gorm, Rannoch, alt. *ca.* 3200 ft., with *Gymn. concinnatum* and *Anth. Juratzkana* (W. E. Nicholson); King's Seat, Killin (S. J. Owen).

Mid E. Highlands.—*Forfar:* Camlochan, with *Nard. scalaris, Ceph. bicuspidata*, and *Anthelia*, 1904 (Ew. and Young).

N.E. Highlands.—*E. Inverness:* Coire Schneada, Cairn Gorm, with *Anth. Juratzkana*, alt. 3200 ft., 1898 (Macv.).

W. Highlands.—*W. Inverness:* Ben Nevis on bare soil, per., alt. 3600–3800 ft., with *Gymn. varians, Anth. Juratzkana, Rhacomitrium fasciculare, R. heterostichum, Polytrichum sexangulare, Dicranum falcatum*, 1904 (Macv.); do., 1908 (J. B. Duncan and H. H. Knight).

Nardia hyalina (*Lyell*) *Carr.*

Widely distributed from Wigtown to Shetland, but an uncommon plant in general. In the Lowlands it is locally common, rather more frequently so in the west than in the eastern counties, but is rare in the Upper Clyde and Upper Tweed districts. It is uncommon in the Eastern Highlands, being rare over considerable tracts. In the West Highlands it is generally distributed as a frequent plant, and is very common in ravines in some districts. It is frequent in the Inner Hebrides. In the North Highlands it is uncommon. It is a low-ground species, and has not been found above 1000 ft. alt.

Perianths are common; fruit, which is found from April to June, is uncommon.

S.W. Lowlands.—*Dumfries:* Sanquhar district, l.c. at side of streams (Macv.). *Kirkcudbright:* New Galloway (M'And.); Carsphairn (West); Penkill Burn (Macv.). *Wigtown:* Aldouran Glen (Macv.).

N.W. Lowlands.—*Ayr:* Fairlie (Ewing); Ladyland Moor (Scott). *Renfrew:* Kelly Glen (Ewing). *Lanark:* Elvanfoot, r. (Macv.); head of Evan Water, r. (Macv.).

E. Lowlands.—*Peebles:* Cowie's Linn (Evans); Carton Burn, r. (Macv.); Talla W. (Macv.). *Selkirk:* Crossleugh Burn (Evans). *Haddington:* Dunglass (M'And.). *Edinburgh:* Rosslyn Wood, 1841 (Grev. Herb.); Hawthornden

(M'And.); Roslin Glen, cfr. (Evans); nr. Pomathorn, wet bank on roadside (Evans); Gutterford Burn (Evans). *Linlithgow:* Nr. Bathgate (Evans).

S.E. Highlands. — *Fife and Kinross:* Lomond Hills (Ewing). *E. Stirling:* Wester Glen, Gargunnock (K. & S.). *S. Perth:* Strathyre, cfr. v.c. (Macv.). *Mid Perth:* Morenish nr. Killin (Macv.); Ben Odhar Burn, f. (Macv.); Achrioch Burn (Macv.); Am Binnean (Young). *N. Perth:* Glas Thalachan (Ferg.).

Mid E. Highlands.—*Forfar:* Kinnordy (Lyell *cf.* Carr. Brit. Hep., p. 35); Glenesk, Forfar, 1830 (Greville *loc. cit.*); Ravine of the Mourin, 1862 (Croall); Fern (Ferg.); Leytack (Ferg.). *Kincardine:* Invery (Sim); Kerloch (Sim); Dalfro (Sim). *S. Aberdeen:* Braemar, cfr., 1853 (Croall *cf.* Carr. Brit. Hep., p. 35); Glen Beg, Braemar (Stabl.); Ballochbuie (Stabl.).

N.E. Highlands.—*Banff:* Tomintoul (Miss Macv.). *E. Inverness:* Nr. Aviemore (Miss Macv.); Glen Tromie (Miss Macv.).

W. Highlands.—*Kintyre:* Clachan (Macrae). *Clyde Isles:* Corrie, Arran (Ewing); L. Ranza (Macv.). *Dumbarton:* Dumbarton, cfr., 1865 (A. M'Kinlay *cf.* Carr. Brit. Hep., p. 35); Ardlui, c. (Macv.); Arrochar, r.c. (Macv.); Loch Humphrey (West); Helensburgh (Ewing); Garelochhead (Scott). *W. Stirling:* Inversnaid, c. (Macv.). *Argyll:* Sandbank (Ewing); Kentallen (Macv.); nr. head of Loch Long (Macv.); Loch Awe Station, c. (Macv.); Ben Cruachan, l.c. to 1000 ft. (Macv.); Glen Nant, u. (Macv.); Ben an Dothaidh (Ewing and Macv.). *W. Inverness:* Moidart, f. (Macv.); Ardnamurchan, f. (Macv.); Sunart, f. (Macv.); Glen Nevis (Macv.); Spean Bridge (Miss Macv.).

Inner Hebrides. — *S. Inner Hebrides:* Ardbeg, Islay (Gilm.). *Mid Inner Hebrides:* Tobermory (Macv.); Dervaig (Macv.); Allt na Searmoin (Kenn.). *N. Inner Hebrides:* Mill Burn, Broadford, r. (Macv.); Sligachan (Miss Macv.).

Outer Hebrides.—Tarbert (West).

Lower N. Highlands.— *W. Ross:* Strome Ferry (Macv.); Strathcarron, c. (Macv.). *E. Ross:* Achnasheen, u. (Macv.); Loch Luichart (West).

Upper N. Highlands.—*E. Sutherland:* The Ord nr.

Helmsdale (Lillie). *W. Sutherland:* Strath Naver (Lillie). *Caithness:* Langwell (Lillie); Watten, cfr. (Lillie).

SHETLAND.—Yell (Sim); Unst (Sim).

var. COLORATA *Nees*

E. LOWLANDS.—*Edinburgh:* Rosslyn Wood (Evans).

W. HIGHLANDS.—*Clyde Isles:* Glen Chalmadale, Arran (Macv.).

NARDIA OBOVATA (*Nees*) *Carr.*

Generally distributed except in the low-lying parts of the Lowlands and East Highlands. Is rare in the West Lowlands, except in the subalpine region, where it is occasionally frequent but not common. Is very rare in the East Lowlands, and is confined to the subalpine region, seldom occurring below 1200 ft. alt. It is common over all the hilly districts of the Highlands, descending to sea-level and ascending to 2500 ft. alt. in Inverness and 3200 ft. alt. in Perth.

It grows in dark-green tufts on wet rocks, especially by the side of streams, also on marshy ground on the hills. The size of the plant varies from a small form on decaying rocks on the low ground (v. *minor* Carr.) to large forms on dripping rocks (v. *elongata* Nees) and as a submerged form (v. *rivularis* Schiffn.). These wet-ground forms have paler rhizoids and thinner walls of the leaf-cells.

Perianths are usually present except in the submerged plant, and fruit is very common. It is found mature from April to June on the low ground, and to August on the hills.

S.W. LOWLANDS.—*Dumfries:* Penton Linn (Scott); Crawick Water (Macv.). *Kirkcudbright:* New Galloway (M'And.); Carsphairn (West). *Wigtown:* Knowe (Ewing).

N.W. LOWLANDS.—*Ayr:* Barrhill (Ewing); Loch Doon (West); Ladyland (Scott). *Renfrew:* Gourock (Ewing); Lochwinnoch (Ewing); Glen, Misty Law, several places, cfr. (Scott). *Lanark:* Falls of Clyde, cfr. (Young); Allershaws Burn (Macv.); head of Evan Water (Macv.); Green Lowther, cfr. F. 1700–2000 ft. (Macv.).

E. LOWLANDS.—*Peebles:* Logan Water, alt. 1200 ft., R. (Macv.); Carton Burn, alt. 1250 ft., R. (Macv.); Talla W., R.C. above 1000 ft. alt. (Macv.). *Selkirk:* Glenkinnon

Burn, alt. *ca.* 500–600 ft., F. (Macv.). *Edinburgh:* Allermuir Burn (Evans); Logan Water, cfr. (Evans).

S.E. HIGHLANDS.—*E. Stirling:* Head of Boquhan Burn, cfr. (K. & S.). *S. Perth:* Strathyre, cfr. (Macv.); Trossachs, cfr. (Ewing). *Mid Perth:* Killin district, C. on low ground and on the hills to 3200 ft. alt., cfr. C. (Macv.); Ben Laoigh (Macv.); Ben Dubh Craige, cfr. C. (Macv.); Ben Odhar, cfr. (Macv.); Achrioch Wood (Macv.); Coire Ardran (Macv.); Braan, Inver., cfr. (M'In.). *N. Perth:* Ben Gulabin (Ewing and Young).

MID E. HIGHLANDS.—*Forfar:* The Burn, cfr., 1852 (Croall); Head of Noran, cfr. (Ferg.); Auchphersie (Ferg.); Glenogil (Ferg.); Clova (Ferg.); Reeky Linn, cfr. (Aimer); Glen Isla (G. West). *Kincardine:* Den of Garol (Sim); Dalfro (Sim). *S. Aberdeen:* Lochnagar (Sim); Ballochbuie Forest (Stabl.); Glas Meol (Ewing and Young).

N.E. HIGHLANDS. — *Banff:* Tomintoul (Miss Macv.). *Elgin:* Linn of the Shogle, 1848 (Croall). *E. Inverness:* Kincraig (Miss Macv.); Glen Tromie (Miss Macv.).

W. HIGHLANDS.—*Kintyre:* Campbeltown (Ewing). *Clyde Isles:* Goatfell (Campb.); L. Ranza, cfr. (Macv.). *Dumbarton:* Ben Vorlich, alt. 2000 ft. (Macv.); Arrochar, R. (Macv.); Tarbert (Macv.). *W. Stirling:* Campsie, cfr. (Ewing). *Argyll:* Sandbank (Ewing); Coire Athoich (A. Murr.); nr. Loch Awe Station, cfr. (Macv.); Ballachulish, V.C. on granite (Macv.); Ben Doureann, C. (Ewing and Macv.); Kentallen, cfr. R.C. (Macv.); Ben Arthur (Macv.). *W. Inverness:* Coire Arder, cfr. (Ferg.); Ben Nevis (Macv.); Glen Nevis (Macv.); Moidart, R.C. (Macv.); Ardnamurchan, F. (Macv.); Sunart, F. (Macv.).

INNER HEBRIDES. — *S. Inner Hebrides:* Jura, cfr. (Ewing). *Mid Inner Hebrides:* Nr. Tobermory (Kenn.); Ben More (Kenn.). *N. Inner Hebrides:* Mill Burn, Broadford, R. (Macv.).

OUTER HEBRIDES.—Barra (Ewing); Harris (Ewing).

LOWER N. HIGHLANDS.—*W. Ross:* Ben Slioch (How.); Strathcarron, R.C. (Macv.); Strome Ferry (Macv.). *E. Ross:* Achnasheen, F. (Macv.).

UPPER N. HIGHLANDS.—*E. Sutherland:* Strath Ullie (Lillie); Ben Griam Mohr (Lillie); nr. Rogart (Lillie). *W. Sutherland:* Strath Halladale, several places (Lillie).

CAITHNESS: Dunbeath Strath (Lillie).
SHETLAND.—Unst (Sim).

var. MINOR *Carr.*

W. HIGHLANDS.—*Clyde Isles:* Loch Ranza, cfr. (Macv.). *W. Inverness:* Moidart, cfr. (Macv.).

NARDIA SUBELLIPTICA *Lindb.*

Has been found only in a few places on the Ben Lawers range of mountains from 1800–3000 ft. alt. It occurs as small tufts on wet rock ledges and wet stony ground. Herr Kaalaas writes of the Craig-an-Lochain plant: "The specimens of *Nardia subelliptica* are a little larger than the plants I have seen from Norway, but in all essential characters they agree very well with the original specimens of Lindberg, especially in the form and structure of the perianth: the difference in the form of the inner bract is not considerable."

Perianths are always present.

S.E. HIGHLANDS.—*Mid Perth:* Craig-an-Lochain, Killin, cfr., alt. 1800–2000 ft., 1900 (Macv.); Ben Lawers, cfr., alt. 3000 ft. (Macv.).

HAPLOZIA Dum.

HAPLOZIA CRENULATA (*Sm.*) *Dum.*
Jung. crenulata Sm.
Nardia crenulata (Sm.) Lindb.

Generally distributed on the low ground from Dumfries to Shetland, but nowhere common. It is rather rare in the Lowlands, and is seldom met with in the Upper Clyde and Upper Tweed districts. Is more frequent in the East and West Highlands, but is rare in the Hebrides. It appears to be rare in the North Highlands. It is rare in Orkney and in Shetland. Although usually confined to the low ground, it has been found on a roadside at 1800 ft. alt. in Mid Perth.

It occurs in low spreading patches of a green to orange-brown colour on loamy soil, most commonly on banks and roadsides.

Perianths are usually present, and fruit, which is mature from March to June, is common.

The var. *gracillima* is also generally distributed on the low ground from Dumfries to Shetland. It is a much more common plant than the type, and is frequent in most districts. It is frequent in both the West and East Lowlands, being rather common in the Upper Clyde and Upper Tweed districts to 1200 ft. alt. Is frequent in the East Highlands and common in the West Highlands, but is uncommon in the Hebrides. Is rather common in West Ross, though it does not appear to be generally so in the North Highlands. It is uncommon in Orkney and Shetland.

This variety is more confined to the low ground than is the type, and is seldom found above 1000 ft. alt., except in a few parts of the Lowlands. It grows in similar places to the type, but is often seen on wetter ground. It forms thin patches on soil, or mixed with other species, as with *Cephalozia bicuspidata*. Is usually green, though reddish on dry ground. Sterile plants are common, but perianths are frequent; fruit, which is mature from March to August, is not rare.

S.W. Lowlands.—*Dumfries:* Crawick Water (Macv.). *Kirkcudbright:* New Galloway (M'And.).

N.W. Lowlands.—*Ayr:* Barrhill, cfr. (Ewing). *Lanark:* Elvanfoot, cfr. R. (Macv.).

E. Lowlands.—*Peebles:* Carlops (Evans). *Selkirk:* Nr. Selkirk, per. (Evans); Bowhill (Evans). *Roxburgh:* Kelso, per. & ♂ (Scott). *Berwick:* Nr. Carfrae (Evans); Cockburnspath (M'And.). *Haddington:* Gifford, per. (Evans). *Edinburgh:* About Edinburgh (Mr Shute *cf.* Hook. Brit. Jung., p. 37); Auchendinny Woods (Grev. *cf.* Fl. Edin., p. 273); Balerno Moss, per. (Macv.); Newbattle Abbey (Evans); Dalmahoy Hill (Evans). *Linlithgow:* Drumshoreland (Evans).

S.E. Highlands.—*Fife and Kinross:* Lomond Hills, several places, per. & ♂ (Young); Pouring Den (Young); Aberdour (M'And.). *Mid Perth:* Kiltyrie, Killin, per. (Macv.); Creag-an-Lochain, alt. 1800 ft. (Macv.); Ben Odhar, alt. 1300 ft. (Macv.). *N. Perth:* King's Seat (Ferg.); Hill of Cochrage (Ferg.); Stormontfield, per. (Meld.).

Mid E. Highlands.—*Forfar:* Kinnordy (Lyell *cf.* Hook. Brit. Jung., p. 37); The Burn, 1862, cfr. (Croall); Monikie (Ferg.); Auchphersie, ♂ (Ferg.); Fern, cfr. (Ferg.); Glenogil (Ferg.). *Kincardine:* Kerloch, cfr. (Sim); Gateside, per. (Sim); Scolty, per. (Sim); Cairn o' Mount (Sim). *S. Aberdeen:* Glen Cluny, Braemar, per., 1856 (Croall); Ardlair (Sim).

N.E. Highlands.—*Elgin:* Glen Beg nr. Grantown, per. (Miss Macv.). *E. Inverness:* Kilravock Wood, Nairn, cfr., 1848 (Croall); above Lochan Dorb, Nairn (Miss Macv.); Laggantigown nr. Aviemore (Miss Macv.); Carr Bridge, ♂ (Miss Macv.); Glen Tromie (Miss Macv.).

W. Highlands.—*W. Stirling:* Inch Cailleach (K. & S.). *Argyll:* Sandbank, cfr. (Ewing); Loch Awe district, u. per. (Macv.). *W. Inverness:* Moidart, f. (Macv.); Ardnamurchan (Macv.); Sunart (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Ardimersay, Islay, per. (Gilm.); Machrie, ♂ (Miss Evans). *Mid Inner Hebrides:* Salen, Mull (Kenn.). *N. Inner Hebrides:* Sligachan (Ewing); Mill Burn, Broadford, r. (Macv.).

Outer Hebrides.—Benbecula (Ewing); N. Uist (West).

Lower N. Highlands.—*W. Ross:* Achnashellach (West); Loch Maree (Miss Macv.). *E. Ross:* Achnasheen, per. (Macv.).

Upper N. Highlands.—*E. Sutherland:* Nr. Rogart (Lillie). *Caithness:* Watten, per. (Lillie); Lybster, per. (Lillie).

Shetland.—Yell (Sim); Bressay, per. (West).

var. gracillima (*Sm.*)

S.W. Lowlands.—*Dumfries:* Nr. Thornhill (Scott); Moffat (Miss Macv.); Langholm (Ewing); Sanquhar district, r.c. (Macv.); Crichope Linn (Macv.). *Kirkcudbright:* New Galloway (M'And.); Loch Trool (Macv.). *Wigtown:* Dunsky, roadside bank (Macv.); nr. Penningham (Macv.).

N.W. Lowlands.—*Ayr:* Beith, per. (Ewing); Glen Afton, f. (Macv.); Ladyland, per. (Scott). *Renfrew:* Loch Thom, per. (Ewing); N. of Glenlora, on old road (Scott). *Lanark:* Carstairs Moss (Macv.); Elvanfoot district, c. (Macv.); Leadhills, f. (Macv.); Kirk Burn, Tinto (Macv.).

E. Lowlands.—*Peebles:* Nr. Cowie's Linn (A. Murr.); Logan Water, R.C. to 1200 ft. alt. (Macv.); Carton Burn, L.C. (Macv.). *Selkirk:* Philiphaugh, ♂ (Evans); Bowhill (Evans); St Mary's Loch (Evans); Galashiels, roadside bank (Macv.); Glenkinnon Burn, C. (Macv.). *Roxburgh:* Melrose district, F. to 1150 ft. alt. (Macv.). *Haddington:* Nr. Gifford (Evans); Dunglass (Evans); Lammer Law (Evans); Yester Woods, cfr. (Evans). *Edinburgh:* Nr. Edinburgh (Grev. *cf.* Fl. Edin., p. 273); Balerno Moss, per. (M'And.); Auchendinny (M'And.); nr. Pomathorn, per. (Evans). *Linlithgow:* Without locality, in a field (Scott).

S.E. Highlands.—*Fife and Kinross:* Lomond Hills (Young); Ballo, cfr. (Evans). *S. Perth:* Doune (Ewing); Trossachs (Ewing); Strathyre (Macv.). *Mid Perth:* Killin district, F. (Macv.); Inver Wood, ♂ (M'In.); Methven, ♂ (Meld.). *N. Perth:* Spittal of Glenshee, near Hotel (Ewing and Young).

Mid E. Highlands.—*Forfar:* The Burn, ♂ (Croall); Fern, per. (Ferg.); Leytack, per. (Ferg.); Auchphersie, per. (Ferg.); Sands of Barrie (Ferg.); Sidlaws (Aimer). *Kincardine:* Gateside, per. (Sim); Scolty, per. (Sim); Bogindreep (Sim). *S. Aberdeen:* Balmoral (Michie). *N. Aberdeen:* Mormond Hill (Ewing).

N.E. Highlands.—*Banff:* Tomintoul, ♂ (Miss Macv.). *Elgin:* Glenbeg nr. Grantown, per. (Miss Macv.). *E. Inverness:* Kilravock Wood, Nairn, 1846 (Croall); Loch Vaa (Miss Macv.); Carr Bridge (Miss Macv.); Kincraig (Miss Macv.).

W. Highlands.—*Kintyre:* Campbeltown, cfr. (Ewing); nr. Lochgilphead (Ewing). *Clyde Isles:* Loch Ranza, R. (Macv.). *Dumbarton:* Helensburgh (Ewing); Ardlui (Macv.). *W. Stirling:* Inversnaid (Macv.). *Argyll:* Puck's Glen (A. Murr.); Dunoon, cfr. (Ewing); Glen Nant (Macv.); Loch Awe (Macv.); Loch Bhe, v.c. and cfr. C. (Macv.); Loch Tulla (Macv.). *W. Inverness:* Moidart, C. (Macv.); Ardnamurchan (Macv.); Sunart (Macv.); Spean Bridge (Macv.); Glen Nevis, roadside (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Ardbeg, Islay (Gilm.). *Mid Inner Hebrides:* Tobermory, U. (Macv.); Dervaig, U. (Macv.).

Outer Hebrides.—Tarbert (West); Harris (Ewing).

LOWER N. HIGHLANDS.—*W. Ross:* Ben Slioch (How.); Strathcarron, R.C. (Macv.); Stromo Ferry (Macv.); Gairloch (Miss Macv.). *E. Ross:* Achnasheen (Macv.).

UPPER N. HIGHLANDS.—*E. Sutherland:* Nr. Loth (Lillie). *W. Sutherland:* Strath Naver (Lillie). *Caithness:* Scottach (Lillie); Watten, per. (Lillie).

ORKNEY.—Stennis, cfr. (Lillie).

SHETLAND.—Yell (Sim); Whalsey (Lillie).

HAPLOZIA SPHÆROCARPA (*Hook.*) *Dum.*
Jung. sphærocarpa Hook.

This species has been found only in a few scattered localities from Dumfries to Caithness. It is more frequent on the hills of Perthshire than elsewhere, though it is rare even there. On high exposed ground it is found as var. *lurida* (Dum.), as on the summit of Craig Chailleach, Mid Perth, the original station of Hooker's *Jung. pumila* var. *nigricans*. This species is rarely found on the low ground; the only locality where it has hitherto been found in the Lowlands is at about 800 ft. alt. It has been found near sea-level in the North Highlands.

It occurs as dark-green tufts at the side of streams and in wet or moist soil. Perianths are usually present; and fruit, which is mature in June and July, is frequent.

S.W. LOWLANDS.—*Dumfries:* Crawick Water, per. R. (Macv.).

E. LOWLANDS.—*Edinburgh:* Bilston Glen, per. (M'And.).

S.E. HIGHLANDS.—*E. Stirling:* Ben Lomond, per. (Kids. and Stir.). *Mid Perth:* Ben Heasgarnich, cfr. (Ewing); do., per. (West); Ben Laoigh (Ewing). *N. Perth:* Glen Tilt, 1879 (Ferg.).

MID E. HIGHLANDS.—*Kincardine:* Kerloch, per. (Sim).

N.E. HIGHLANDS. — *E. Inverness:* Mam Soul, per. (Cocks).

W. HIGHLANDS.—*Argyll:* Coire Ghlais, Ben Cruachan, per. (Macv.).

UPPER N. HIGHLANDS.—*E. Sutherland:* R. Lettie (Lillie). *W. Sutherland:* Strath Halladale, per. (Lillie); between Durness and Tongue, per. (Lillie). *Caithness:* Camster (Lillie).

var. LURIDA *Dum.*

S.E. HIGHLANDS.—*Mid Perth:* Craig Chailleach, *sub nom. Jung. pumila* var. *nigricans* (Hook. *cf.* Brit. Jung., p. 17); do., per., alt. 2900 ft. (Macv.); Meal Tarmachan (C. J. Wild *cf.* Pears. Hep. Brit., p. 299); King's Seat, Killin (Evans). *N. Perth:* Glen Beg, Glen Shee (Ferg.).

HAPLOZIA CORDIFOLIA (*Hook.*) *Dum.*

Jung. cordifolia Hook.

An uncommon species in general, but usually found in some quantity where it does occur. It is rare in the Lowlands, and is seldom to be found below 900 ft. alt. It is quite a common species on the hills of Mid and North Perth and in parts of the Cairngorms, and has been found in many parts of Forfar. Towards the west side of the country it becomes rarer, and is rare near the west coast; in the latter district it is absent from large tracts of the country, especially to the north of Loch Linnhe. It has not been found in the Hebrides and is rare in the North Highlands. This species is most frequent at elevations above 2000 ft. and ascends to 3600 ft. alt.

It forms large dark-green masses in springs, also in marshes, and more rarely on rocks at the side of streams. Fruit, which is mature in June and July, occurs abundantly on the higher ground, but is rare below 2000 ft., and appears to be absent when the station is below 1000 ft. alt.

S.W. LOWLANDS.—*Dumfries:* Black's Hope Glen, Moffat, 1858 (Nichol). *Kirkcudbright:* Garpel Burn, New Galloway (M'And.).

N.W. LOWLANDS.—*Lanark:* Leadhills (Lyon); do., v.c. from 1700–1900 ft. alt. on Green Lowther, cfr. (Macv.); Kirk Burn, Tinto, alt. 850–900 ft. (Macv.).

E. LOWLANDS.—*Peebles:* North Esk, behind Carlops, ♀ (Evans); Carton Burn, alt. 900 ft., R. (Macv.). *Edinburgh:* Pentland Hills, ♀ (A. Murr.); R. Almond (M'And.).

S.E. HIGHLANDS.—*S. Perth:* Menstrie Glen (Evans); Bencleuch (Evans). *Mid Perth:* Ben Lawers, 1823 (Grev.); do., 1842 (Gard.); do., cfr. C. alt. 2500–3300 ft. (Macv.); Creag-an-Lochain, cfr. (Macv.); Cam Creag, cfr. (Macv.);

Finlarig Burn (Macv.); Creag Mhor (Cocks); Ben Heasgarnich (Young); Ben Challum (Ewing); Ben Laoigh, cfr. c. (Macv.); Ben Odhar (Macv.); Ben Vorlich (Evans); Kennacoil, Strathbraan (M'In.); Stuc-a-Croin, 1841 (Gard.). *N. Perth:* Glen Beg, Glen Shee (Ferg.); Glas Meol (Stabl.); Ben-y-gloe, ♂ (Holmes); Carn Mohr, Glen Shee, ♂ (Ewing); Glen Tilt (West).

Mid E. Highlands.—*Fife and Kinross:* Isla and Catlaw, per. (Lyell *cf.* Hook. Brit. Jung., p. 32); Clova Mountains, 1824 (Grev.); Drylinn rivulet, Sidlaw Hills, 1840 (Gard.); Werron, 1841 (Ed. Herb.); Head of Noran (Ferg.); Glamis (Ferg.); Trusto (Ferg.); Auchphersie (Ferg.); Brandy Burn, Clova (Ferg.); Leytack (Ferg.). *Kincardine:* Den of Garol, per. (Sim); Den of Lathers (Sim). *S. Aberdeen:* Lochnagar (Dickie); do., per. (Sim); Corrie Ceannor (West).

N.E. Highlands.—*E. Inverness:* Braeriach (Wheldon *in litt.*).

W. Highlands.—*Dumbarton:* Arrochar (Macv.); Ben Vorlich, alt. 2000 ft., r. (Macv.); Loch Humphrey (Ewing). *W. Stirling:* Ballagan (J. Murr.). *Argyll:* Coire Athrioch, Ben More, ♂ (A. Murr.); Ben Doureann, u. (Ewing and Macv.); Ben Arthur, alt. 2000–2200 ft., f. per. (Macv.). *W. Inverness:* Ben Nevis (Whitehead); Choir Arder, alt. 3600 ft. (Ferg.).

Lower N. Highlands.—*W. Ross:* Ben Liath Mohr, alt. 800 ft., r. (Macv.).

Haplozia riparia (*Tayl.*) *Dum.*

Jung. riparia Tayl.

One of our most generally distributed species. Is uncommon in most parts of the West Lowlands and rare in the Upper Clyde district. It is more frequent in the Lothian counties of the East Lowlands, but is rare in Upper Tweed district. Is rather a common species in Fife and in the Highlands generally, both east and west, and extending to Shetland. The most frequent station for it is on rocks at the side of streams in dens and ravines. This is particularly the case when in the Lowlands. In the Highlands it is also often to be found on wet rocks unconnected with

streams and sometimes in marshes, but is most common near the base of the hills. It is uncommon above 2000 ft. alt., though ascending to 3200 ft. in Mid Perth. This species does not show any particular preference for limestone in Scotland, as it is stated to do on the Continent. It appears to be a commoner plant with us than in other parts of Europe, and limestone is a rare formation in this country.

It grows in dark olive-green or dirty green tufts, or in thin creeping patches on wet rocks. In the latter case it is sterile, but in its usual compact state fruit is common, and is mature from March to June and occasionally to August. Perianths are usually present at all times of the year.

The var. *potamophila* is here intended for the large form with somewhat the appearance of *H. cordifolia*.

S.W. Lowlands.—*Dumfries:* Sanquhar district, U. (Macv.). *Kirkcudbright:* Garpol Burn (M'And.); Holms Glen, cfr. (M'And.); Glenlee Glen, per. (M'And.). *Wigtown:* Portpatrick, per. (M'And.); Clendy Glen, per. (M'And.).

N.W. Lowlands.—*Ayr:* Largs, cfr. (Ewing); Ness Glen (M'And.). *Renfrew:* Cloch (West). *Lanark:* Leadhills (Lyon); Elvanfoot, R. (Macv.).

E. Lowlands.—*Peebles:* Carlops (Evans); Cowie's Linn, cfr. (A. Murr.); above Medwynhead (Evans). *Selkirk:* Bowhill (Evans); Ashiestiel, foot of wet wall (Macv.); Lindean, U. (Macv.); Yarrow, a few places (Macv.). *Roxburgh:* Nr. Kelso (Scott). *Berwick:* Cockburnspath (M'And.). *Haddington:* Dunglass Dean, per. (Evans); Oldhamstocks, per. (Evans); Newlands, per. (Evans). *Edinburgh:* Pentlands (A. Murr.); nr. Edgelaw (Evans); Torduff Reservoir (M'And.); Arniston Glen, per. (M'And.); Clubbiedean (M'And.); Bonally Burn, per. (M'And.); Hawthornden, per. (M'And.); Cramond (M'And.); Logan Burn, per. (A. Murr.); Loganlee, cfr. (Evans); Moorfoot Water, cfr. (Evans). *Linlithgow:* Carriber Glen, per. (Evans); Dalmeny (Evans).

S.E. Highlands.—*Fife and Kinross:* Raith (Young); Lomond Hills, per., several places (Young); Glen Burn, per. (Evans); Glen Queich, cfr. (Evans); Kiels Den, per. (M'And.); Largo Links (M'And.); Auchtertool, per. (Young).

S. Perth: Alva Glen, per. (Croall); Menstrie Glen, per. (Evans); Strathyre, per. (Macv.); Trossachs, cfr. (Ewing); Tillicoultry Glen (Evans). *Mid Perth:* Breadalbane (Grev. Herb.); Killin district, R.C. ascending to 3200 ft. alt. (Macv.); Ben Odhar, F. (Macv.); Ben Dubh Craige (Macv.); Clifton Burn (Macv.). *N. Perth:* Glen Beg, Glen Shee (Ferg.); Glen Tilt (Ferg.); Glas Thulachan (Ferg.); Lorronty Burn (Ferg.); Ben Gulabin (Ew. and Young).

Mid E. Highlands.—*Forfar:* The Burn, cfr., 1862 (Croall); Auchphersie (Ferg.); Fullerton (Ferg.); Den of Airlie, per. (Ferg.); Reeky Linn, per. (Aimer). *Kincardine:* Den Fenella (Ferg.); Den of Lathers (Sim). *S. Aberdeen:* Lochnagar (Sim); Ballochbuie Forest (Stabl.).

N.E. Highlands.—*Banff:* Tomintoul (Miss Macv.). *Elgin:* Above Sluie, 1848 (Croall); Linn of the Shogle, per. 1848 (Croall); Glen Beg, Grantown (Macv.). *E. Inverness:* Glen Tromie, cfr. (Miss Macv.).

W. Highlands.—*Kintyre:* Campbeltown, per. (Ewing); Tarbert (Ewing). *Clyde Isles:* Rothesay, per. (M'And.); nr. Corrie, per. (Miss Macv.); Whiting Bay, per. (Miss Macv.). *Dumbarton:* Allt Dubh Uisgue (Macv.); Loch Humphrey (West). *Argyll:* Lochgoilhead (Hamilton); Glen Nant, U. (Macv.). *W. Inverness:* Moidart, C. (Macv.); Ardnamurchan, F. (Macv.); Sunart, C. (Macv.); Glenfinnan (Macv.); Ben Nevis (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Jura (Ewing); Machrie (Miss Evans). *Mid Inner Hebrides:* Nr. Tobermory, cfr. (Kenn.); Achnadrish (Macv.); Allt na Searmoin (Kenn.). *N. Inner Hebrides:* Canna, per. (Macv.); Broadford district, R.C. per. (Macv.); Sligachan, per. (Miss Macv.).

Lower N. Highlands.—*W. Ross:* Strome Ferry, per. (Macv.); Strathcarron, per. F. (Macv.). *E. Ross:* Loch Luichart (West); Rosemarkie, per. (Miss Macv.).

Upper N. Highlands.—*E. Sutherland:* West Helmsdale, per. (Lillie); Glen of Loth (Lillie); R. Lettie, per. (Lillie). *W. Sutherland:* Strath Halladale, per. (Lillie); Smoo Cave, per. (Lillie). *Caithness:* Reisgill Burn (Lillie); Dunnet Links (Lillie); Stenister Loch, per. (Lillie).

Orkney.—Hoy, per. (West); Finstown, per. (West); Stennis (Lillie).

Shetland.—Northmaven, per. (Sim).

var. POTAMOPHILA *Bernet*

E. LOWLANDS.—*Selkirk:* Glenkinnon Burn (Macv.). *Haddington:* Gullane Links, per. (M'And.).

S.E. HIGHLANDS.—*Mid Perth:* Finlarig Burn (D. A. Jones).

W. HIGHLANDS.—*Dumbarton:* Nr. Arrochar (Macv.).

HAPLOZIA ATROVIRENS (*Schleich.*) *Dum.*

Jung. atrovirens Schleich.

Rare, but found in several scattered localities from sea-level to 3200 ft. alt. Is generally an alpine plant. Is very rare but is occasionally present in subalpine districts. It is very rare in the Lowlands.

Forms small, rarely large, olive-green patches in wet rocky places. Perianths are nearly always present, and fruit is frequent.

N.W. LOWLANDS.—*Renfrew:* Cloch, per., with *Aneura pinguis* (Ewing).

S.E. HIGHLANDS.—*Mid Perth:* Craig-an-Lochain, per. from 1800–2000 ft. alt. (Macv.); Ben Lawers, per. 3200 ft. alt. (Macv.); Cam Creag, per. 2700 ft. alt. (Macv.); Craig Chailleach, per. 2600 ft. alt. (Macv.); Clifton Burn (Macv.).

MID E. HIGHLANDS.—*Forfar:* Below Sheilhill, per., 1878 (Ferg.). *S. Aberdeen:* Corrie Ceandor, per. (West).

W. HIGHLANDS.—*Kintyre:* Tarbert, per. (Ewing). *Clyde Isles:* Rothesay (M'And.).

UPPER N. HIGHLANDS.—*E. Sutherland:* Ben Griam Mohr, per. (Lillie).

SHETLAND.—Northmaven, per., 1878 (Sim).

HAPLOZIA PUMILA (*With.*) *Dum.*

Jung. pumila With.

A generally distributed and not uncommon species. Is frequent in the West Lowlands, and ascends to 2000 ft. alt. in the Upper Clyde districts. It appears to be rarer in the East Lowlands, and is rare in the Upper Tweed valley. Is rather common in several parts of the East Highlands,

especially in Mid Perth. It is a common species in West Inverness, but uncommon in most other parts of the West Highlands. Has only been found as yet in a few localities of the North Highlands, and has not been found in Shetland. It is generally confined to the low ground, but ascends to 1800 ft. alt. in Mid Perth in one locality among alpine species.

It occurs as small spreading patches of a dark-green or olive-green colour closely attached to rocks, usually by the side of streams in ravines; also occasionally in damp gravelly places, especially on roadsides. Perianths are nearly always present, and fruit is very common in spring and is sometimes present throughout summer until October.

S.W. Lowlands.—*Dumfries:* Sanquhar district, f., cfr. (Macv.); Crichope Linn (Macv.). *Kirkcudbright:* Glenlee Glen, New Galloway (M'And.); Knocknairling Glen (M'And.); Penkill Burn (Macv.); L. Wingeon (G. West). *Wigtown:* Aldouran Glen, cfr. (Macv.).

N.W. Lowlands.—*Ayr:* Auchenleck, cfr. (Ewing); Largs, cfr. (Ewing). *Renfrew:* Lochwinnoch (Ewing). *Lanark:* Elvanfoot district, f. at sides of streams, cfr. (Macv.); Green Lowther, r.c. from 1700–2000 ft. alt., cfr. (Macv.); Tinto (Macv.).

E. Lowlands.—Cowie's Linn, cfr. (M'And.); Carton Burn, cfr., alt. 200 ft. r. (Macv.); Talla W., cfr., alt. 900 ft. (Macv.). *Selkirk:* Crossceugh Burn (Evans). *Roxburgh:* Melrose district, in deans, u. (Macv,). *Berwick:* Cockburnspath (M'And.). *Edinburgh:* Roslin Glen, cfr. (A. Murr.); Logan Burn (A. Murr.); Bilston Glen (Evans); Bonally Burn (M'And.). *Linlithgow:* Craighall (M'And.).

S.E. Highlands.—*Fife and Kinross:* Glen Burn (Evans); Tulliallan Lake (Evans). *S. Perth:* Strathyre (Macv.); Trossachs, cfr. (Ewing); Tillicoultry Glen, cfr. (Evans). *Mid Perth:* Killin (Holt *cf.* Pears. Hep. Brit., p. 293); Killin district, c. on low ground (Macv.); Craig-an-Lochain, alt. 1800 ft. (Macv.); Achrioch Wood, Tyndrum, in stream (Macv.); Clifton Burn, r.c. (Macv.). *N. Perth:* Ben Gulabin (Ewing and Young); Spittal of Glenshee (Ewing and Young).

Mid E. Highlands.—*Forfar:* The Burn, 1862 (Croall);

Fern, cfr. (Ferg.); Glenogil, cfr. (Ferg.); Den of Airlie, cfr. (Ferg.); Camlochan (Ferg.). *Kincardine:* Commonty, cfr. (Sim); Feugh Rocks, cfr. (Sim); Lathers (Sim).

N.E. Highlands.—*Elgin:* Linn of the Shogle, cfr., 1848 (Croall); Dreggie Burn nr. Grantown (Miss Macv.). *E. Inverness:* Glen Tromie, cfr. (Miss Macv.); Loch Insh (Miss Macv.).

W. Highlands.—*Clyde Isles:* Loch Ranza, cfr., R. (Macv). *Dumbarton:* Ardlui (Macv.); Arrochar, C., cfr. (Macv.). *W. Stirling:* Inversnaid (Macv.). *Argyll:* Glen Nant, U. (Macv.); Loch Awe district, U. (Macv.); Ben an Dothaidh (Ewing and Macv.); Meal Odhar (Macv.); Kentallen (Macv.). *W. Inverness:* Moidart, C. (Macv.); Ardnamurchan, C. (Macv.); Sunart, C. (Macv.); Glen Nevis, roadside, cfr. (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Jura, cfr. (Ewing). *Mid Inner Hebrides:* Tobermory (Macv.); Ben More (Kenn.); Allt na Searmoin (Kenn.). *N. Inner Hebrides:* Mill Burn, Broadford, C. (Macv.).

Outer Hebrides.—Tarbert (West).

Lower N. Highlands.—*W. Ross:* Strome Ferry (Macv.); Strathcarron, U. (Macv.). *E. Ross:* Fairy Glen, Rosemarkie, cfr. (Miss Macv.).

Upper N. Highlands.—*W. Sutherland:* Farr, cfr. (Lillie). *Caithness:* Dunbeath Strath (Lillie); Roster Burn, Latheron (Lillie).

Orkney.—Finstown (West).

JAMESONIELLA (Spruce) Steph.

Jamesoniella autumnalis (*DC.*) *Steph.*

Jung. autumnalis DC.
J. subapicalis Nees

Has only been found in a few scattered localities on both sides of the country. It has not been found in the North Highlands. Occurs on half-buried stones and rocks in shady but not wet places on the low ground of the subalpine region. It has not been found above 1000 ft. alt. on the hills. The var. *Schraderi* is much rarer than

the type and occurs among *Sphagnum*. Perianths are usually present.

S.W. Lowlands.—*Kirkcudbright:* Garroch Wood, New Galloway, per. (M'And.).

S.E. Highlands.—*Mid Perth:* Wood nr. Lochy Bridge, Killin, per. (Macv.).

Mid E. Highlands.—*Forfar:* Clova, 1876 (Ferg.). *Kincardine:* Den of Lathers, 1878 (Sim).

W. Highlands.—*Dumbarton:* Ardlui, per. (Macv.); Arrochar (Lee). *W. Stirling:* Rowardennan (M'And.). *Argyll:* Leithar, Loch Awe, on stump and rock, per. (Macv.); Glen Nant (Macv.). *W. Inverness:* Moidart, Craig Woods, per. (Macv.).

var. Schraderi (*Mart.*)

W. Highlands.—*Argyll:* Entrance to Coire Creachainn, Ben Cruachan, 500 ft. alt., among *Sphagnum*, 1903 (Macv.).

Jamesoniella Carringtoni (*Balf.*) *Steph.*

An Atlantic species, but not confined to the west side of the country. Its distribution extends from the south of Argyll to Sutherland, and it is also found in Mid Perth, the Cairngorms, and Orkney. It is frequent and at times even common on several of the hills of the West Highlands; it is also present in small quantity on some of the hills of the western side of Mid Perth, and in the Aberdeenshire Cairngorms, but appears to be absent in the intervening area. It has been found in the western part of the North Highlands, and only as yet on one of the islands of the Inner Hebrides. The usual locality for this species is on grassy slopes, rock ledges, and among boulders from 1600–2000 ft. alt., but it descends to 1000 ft. alt. in one locality in Argyll and ascends to 2400 ft. The altitude in the Cairngorms has not been noted. This fine species grows in tall, erect yellow-green or pale-green tufts; is frequently unmixed, but more commonly accompanied by *Bazz. tricrenata* and *Anast. orcadensis*, also frequently by *Herberta adunca*, and occasionally when on rock ledges is found among *Sphagnum*.

The male plant is rare; the female has not been met with.

S.E. Highlands.—*Mid Perth:* Ben Lawers, 1866 (Mr Stirton *cf.* Carr. Brit. Hep., p. 22); Ben Laoigh (Wild and Holt *cf.* Pears. Hep. Brit., p. 288); do., with *Bazz. tricrenata* and *Herberta adunca* (Meld.); do., 1600–2000 ft. alt. (Macv.); Ben Heasgarnich with *Herberta adunca* (Meld.); Ben Chuirm (Macv.).

Mid E. Highlands.—*S. Aberdeen:* Braemar, with *Anastrophyllum Donianum, Bazz. tricrenata, Anastrepta orcadensis, Leptocyphus Taylori, Diph. albicans*, 1856 (Croall); Ben MacDhui, with *Leptocyphus Taylori* and *Sphagnum* (Stabl.).

N.E. Highlands.—*Banff:* Head of Loch Avon, with *Anast. Donianum, Bazz. tricrenata, Anast. orcadensis*, 1830 (Grev.).

W. Highlands.—*Dumbarton:* Ben Vorlich (Stirton); do., c. from 1800–2000 ft. alt. (Macv.). *Argyll:* Coire Gabhail, Glencoe, with *Anast. orcadensis, Bazz. tricrenata, Mastig. Woodsii, Scap. ornithopodioides, Leptocyphus Taylori, Herberta adunca*, alt. 1000 ft. (Macv.); Ben Arthur among boulders with *Anast. orcadensis* and *Bazz. tricrenata*, alt. 2400 ft., r. (Macv.). *W. Inverness:* Glenfinnan (Carr *cf.* Pears. Hep. Brit., p. 288); Moidart, on several mountains, alt. *ca.* 1600–2000 ft. (Macv.); Coire Dheirg, Glen Nevis, c. from 1800–2000 ft. alt. (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Jura, with *Bazz. tricrenata, Scap. gracilis, Scap. ornithopodioides* (Ewing).

Lower N. Highlands.—*W. Ross:* Ben Eay, 1867 (How. and Jenner).

Upper N. Highlands.—*Sutherland:* 1824, *sub nom. Jung. compressa* (Grev.).

Orkney.—Glen Trowie, Hoy, with *Anast. orcadensis* and *Bazz. tricrenata* (Lillie).

ANASTROPHYLLUM (Spruce) Steph.

Anastrophyllum Donianum (*Hook.*) *Steph.*

Jung. Doniana Hook.

This is one of the rarer Atlantic species, extending from W. Inverness to Sutherland. As with *Jamesoniella Carringtoni*, it is not confined to the west side of the country,

being found also on the Cairngorms. It occurs in very small quantity, and seldom forms compact masses as in Norway. It is found with us scattered among other species, as *Scap. ornithopodioides* and *Bazz. tricrenata*, on rock ledges and on grassy places among rocks from 1900 ft. to 3600 ft. alt. Perianths and male plants are uncommon, and fruit, which is mature in August, is rare.

S.E. Highlands.—*Mid Perth:* Ben Lawers, 1795 (G. Don *cf.* Hook. Brit. Jung., p. 39).

Mid E. Highlands.—*Forfar:* Clova, 1795 (G. Don *cf.* Hook. Brit. Jung., p. 39). *S. Aberdeen:* Ben a Bourd and Ben MacDhui, 1802 (G. Don *cf.* Hook. Brit. Jung., p. 39); Braemar, 1856 (Croall); Ben MacDhui (Croall); do., with *Anast. orcadensis, Leptocyphus Taylori*, and *Scap. ornithopodioides* (Stabl.); do., with *Calypogeia Trichomanis* and *Diplo. albicans* (Stabl.); do. with ♀ plants (Stabl.); Balmoral, with *Bazz. tricrenata* (Stabl.).

N.E. Highlands.—*Banff:* Cairngorm, 1802 (G. Don *cf.* Hook. Brit. Jung., p. 39); Loch Avon, ♀, 1822 (Grev.); Loch Avon, 1830, cfr. (Grev.); do. (Lyon).

W. Highlands.—*W. Inverness:* Ben Nevis, 1795 (G. Don *cf.* Hook. Brit. Jung., p. 39); Coire Dheirg, Glen Nevis, alt. *ca.* 1900 ft., v.r. (Macv.); Ben Nevis, alt. 3600 ft. (H. H. Knight); Coire nam Feusgam, Glen Nevis (W. E. Nicholson).

Lower N. Highlands.—*E. Ross:* Scuir na Lapaich, per. (Cocks).

Upper N. Highlands.—Sutherland, 1834 (Grev.).

LOPHOZIA Dum.

Lophozia inflata (*Huds.*) *Howe*

Jung. inflata Huds.

Generally distributed from Dumfries to Shetland, but not common except in some of the eastern parts of the country. Its distribution is in great measure dependent on the presence of peat-mosses. Where these are scarce, as in the Lowlands in general, this species is local though usually present, and often in quantity. Through the East Highlands to Caithness it ranks as one of the more common

species, and is common in Orkney and Shetland. On the other hand, it is rather uncommon in the West Highlands, and still more so in the Hebrides. It does not, as a rule, ascend above 1200 ft. alt., but is found to 2700 ft. in Mid Perth, and to 3600 ft. alt. on the Cairngorms. It forms dark-green to blackish-green tufts in peat-mosses, wet moors, and moist places among rocks where there is some mixture of peat. It occasionally occurs on wet rocks on the low ground, but only when in a well-marked subalpine region. In the alpine region of the Highlands it is sometimes found on rocks as a small black form with much the appearance of a *Marsupella*.

Perianths are very common, male plants much less so but still frequent; fruit, which is mature in June, is rare.

S.W. Lowlands.—*Dumfries:* Lochar Moss, 1841 (Gray); Moffat (M'And.); Sanquhar Moor, c. (Macv.). *Kirkcudbright:* New Galloway, cfr. (M'And.); Benman Hill (M'And.); Glen Trool, on a wall, and on wet rocks (Macv.). *Wigtown:* New Luce Moor (M'And.).

N.W. Lowlands.—*Ayr:* Largs (Ewing). *Renfrew:* Loch Thom, c. (Ewing); Kilmalcolm (Scott-Elliot); Misty Law (Scott). *Lanark:* Cobbinshaw (Ewing); Tinto, alt. 1400 ft. (Macv.); Elvanfoot district, f. in peat-mosses (Macv.).

E. Lowlands.—*Peebles:* Cowie's Linn (Evans); nr. Leadburn (Evans); Tweedsmuir (Macv.). *Berwick:* Nr. Seenes Law (Evans); Tallishill (Evans). *Haddington:* Lammer Law (Evans); nr. Gifford (Evans). *Edinburgh:* Pentland Hills (A. Murr.); Balerno Moss, v.c. and cfr. f. (Macv.); Currie Moor (Evans); Dalmahoy (M'And.); Baads (Ewing); Cobbinshaw Moss (Evans); nr. Thriepmuir Reservoir (J. Hunter).

S.E. Highlands.—*Fife and Kinross:* Lomond Hills (Ewing); Binns Quarry (Evans); West Lomond Hill (Young). *E. Stirling:* Murrayshall (K. & S.); Ridgehead Moss (Evans). *S. Perth:* Strathyre (J. Hunter). *Mid Perth:* Craig Mhor (Ewing); Killin district, u. ascending to 2700 ft. alt. (Macv.); Tyndrum district, c. on moors to alt. 1200 ft., cfr. r. (Macv.); Coire Ardran, c. alt. 2000 ft. (Macv.). *N. Perth:* Drumtochty (Ferg.); Hill of Cochrage,

several places (Ferg.): Glas Thalachan (Ewing); Glen Thaitneich (Ewing and Young); Persie (Barker).

Mid E. Highlands.—*Forfar:* Monikie (Ferg.); Fern (Ferg.); Balham Bog, alt. 900 ft. (Ferg.); Caners (Ewing); Camlochan (Ewing and Young); Sidlaws (Aimer). *Kincardine:* Dalfro (Sim); Tillylair (Sim); Mount Shade (Sim); Kerloch (Sim); Migvie Wood (M'And.). *S. Aberdeen:* Summit of Craig Choinneach, 1844 (Gard.); Powlair (Sim); Lochnagar (Sim); Balmoral (Michie); nr. Meal Odhar, alt. 3150 ft. (Ewing and Young). *N. Aberdeen:* Mormond Hill (Ewing).

N.E. Highlands.—*Elgin:* Banks of the Findhorn, 1848 (Croall); Lochan Dorb (Miss Macv.). *E. Inverness:* Carn Dearg, Aviemore (Macv.); above Lochan Dorb, Nairn (Miss Macv.); Carr Bridge (Miss Macv.); moor above Insh (Miss Macv.).

W. Highlands.—*Kintyre:* Tarbert (Ewing). *Clyde Isles:* Rothesay (M'And. *in litt.*). *Dumbarton:* Cumbernauld (Campb.); Milngavie (Campb.). *Argyll:* Ben Cruachan (Croall); nr. head of Loch Long (Macv.); Ben More, Loch Eck (A. Murr.); Lochan Bhe (Macv.); Ben an Dothaidh (Macv.); Ben Arthur, alt. 2000 ft. (Macv.); Puck's Glen (A. Murr.). *W. Inverness:* Moidart, f., cfr. r. (Macv.); Ben Nevis (Macv.).

Inner Hebrides.—*Mid Inner Hebrides:* Tiree (Macv.). *N. Inner Hebrides:* Sligachan (Miss Macv.).

Outer Hebrides.—Nr. Tarbert (West).

Lower N. Highlands.—*W. Ross:* Strathcarron, r. (Macv.). *E. Ross:* Achnasheen (West); Loch Rosque (West); Strathpeffer (M'In.).

Upper N. Highlands.—*E. Sutherland:* Strath Ullie (Lillie). *W. Sutherland:* Forsinard (Lillie); Ben Clibreck (Lillie). *Caithness:* North Watten Moss (Lillie); nr. Swiney (Lillie).

Orkney.—Nr. Kirkwall, several places (West); Stromness (West); Stennis (Lillie); Hoy (Lillie).

Shetland.—Sullam nr. Lerwick (Sim); nr. Bixter, side of ditch (Grieve); Scalloway (West); Unst (Sim); do. (Lillie); Whalsey (Lillie).

Lophozia turbinata (*Raddi*) *Steph.*

Jung. turbinata Raddi

Widely distributed from Kirkcudbright and Berwick to the extreme north of Sutherland and extending to Orkney. It is rare except in the neighbourhood of the coast in the East Lowlands, Fife, and Forfar. In these districts it is locally common. Also in Caithness it has been found in several places. It is very rare in the central parts of Scotland, and it has only been found in the West Highlands in the limestone island of Lismore. It is apparently confined to soils in which there is some mixture of lime, but, when allowance is made for this, the species must still be allowed to have a mainly eastern distribution in this country. It is entirely confined to the low ground, and occurs in light-green to almost black patches on moist soil, most frequently at the side of dens and ravines, and occasionally on moist ground on sand-dunes. Perianths are frequent, though less so than the male plant. Fruit, which is mature from March to June, is frequent.

The localities which are queried may possibly be placed to *L. badensis*, as these specimens have not been seen since the latter was distinguished from *L. turbinata*.

S.W. Lowlands.—*Kirkcudbright:* Orroland, Rerrick (M'And.).

N.W. Lowlands.—*Ayr:* On limestone, Ayrshire (J. A. in Ed. Herb.)? *Lanark:* Cadder nr. Glasgow (Lyon)?

E. Lowlands.—*Berwick:* Cockburnspath (M'And.). *Haddington:* Dunglass Dean (Evans); nr. Haddington (Evans); Gullane Links Quarry (M'And.); Gosford (M'And.). *Edinburgh:* Cramond Bridge, 1856, cfr. (Lowe)?; Bilston Glen (M'And.); Pentland Hills (A. Murr.)?; R. Almond above Cramond Bridge (M'And.); Colinton Dell (M'And.). *Linlithgow:* Dalmeny (Evans)?; below Cramond Bridge (M'And.).

S.E. Highlands.—*Fife and Kinross:* Kenly Den (How.)?; Kinners Burn (How.)?; Kinghorn (M'And.); Keil's Den, Largo (M'And.); St Andrews Bay, cfr. (Aimer); Aberdour Woods (Evans). *S. Perth:* Wharry Road, Bridge of Allan (Evans) *N. Perth:* Glen Beg, Glen Shee (Ferg.)?

Mid E. Highlands.—*Forfar:* Ravine of the Mourin, 1862 (Croall)?; foot of Glenesk (Croall)?; Arbroath (Ferg.)?

W. Highlands.—*Argyll:* Lismore (Macv.); Coire Athoich, Ben More (A. Murr.)?

Lower N. Highlands.—*E. Ross:* Nr. Fortrose (Miss Macv.)?

Upper N. Highlands.—*E. Sutherland:* West Helmsdale (Lillie). *W. Sutherland:* Smoo Cave (Dixon). *Caithness:* Reisgill Burn (Lillie); nr. Thurso (Lillie); Ness Head (Lillie); Stemster Loch (Lillie); Forse, Latheron (Lillie).

Orkney.—Finstown (West).

Lophozia badensis (*Gottsche*) *Schiffn.*

Jung. badensis Gottsche

The distribution of this recently distinguished species is not yet well known. It has been found from Dumfries and Haddington through the East and North Highlands to Caithness, but only in a few localities, and mostly near the coast. It has not been found on the west side of the mainland north of the Clyde, though it occurs in the Outer Hebrides. So far as known, its distribution is very similar to that of *L. turbinata*, being found in similar situations and sometimes with it, though occasionally on drier ground than that species affects. It appears also to require some lime in the soil, and has only been found on the low ground. Fruit, which has been found mature from April to June, appears to be frequent.

S.W. Lowlands.—*Dumfries:* Euchan Water (Macv.).

N.W. Lowlands.—*Ayr:* Mochra Hill (Ewing).

E. Lowlands.—*Peebles:* Banks of Medwyn Water above Medwynhead, 1904 (Evans). *Haddington:* Gullane Links, cfr. (M'And.). *Edinburgh:* On R. Almond above the old mill, Cramond, cfr. (M'And.); Roslin Glen (M'And.). *Linlithgow:* R. Almond (M'And.).

S.E. Highlands.—*Fife and Kinross:* Sandstone wall nr. Falkland, cfr. (Evans). *Mid Perth:* Lawers Den (Macv.).

Mid E. Highlands.—*Forfar:* Rocks at The Burn, foot of Glenesk, 1862 (Croall); Gannochy (Ferg.).

Outer Hebrides.—Harris (Ewing).

Lower N. Highlands.—*E. Ross:* Fairy Glen, Rosemarkie (Miss Macv.).

Upper N. Highlands. — *Caithness:* Atterwall Loch, Bower (Lillie).

Lophozia Muelleri (*Nees*) *Dum.*

Jung. Muelleri Nees

Widely distributed from Dumfries to Shetland, but generally uncommon. Is rare in both East and West Lowlands, Fife, and in the low-lying districts near the coast in the East Highlands. Is rather common in Central Scotland on the mountainous districts of Perth. Is frequent in some parts of the West and North Highlands. Is also frequent in parts of the Inner Hebrides, but has not yet been found in the Outer islands. It is rare in Orkney and Shetland. The part of Scotland where it is in greatest quantity is on the mountains of Mid Perth, where it ascends to 3400 ft. alt. It has not been found on any of the hills of the West Highlands, being confined to ravines and wet rocky banks on the low ground. Perhaps this may be due to its preference for soils which contain lime, as the hills on the west coast are mostly devoid of this. This species is rarely seen below 1000 ft. alt. in the Lowlands, but, as in the case of some other subalpine species, it is also found on moist ground in sand-dunes on the shore.

It grows usually in rather large tufts, sometimes in large spreading masses, of generally a pale-green colour, among wet rocks, rock ledges, and sides of streams, especially of ravines. Sterile perianths are usually present; male plants are also common; fruit is uncommon except on the hills.

S.W. Lowlands.—*Dumfries:* Moffat (M'And.). *Kirkcudbright:* Garpel Burn, New Galloway (M'And.).

N.W. Lowlands.—*Ayr:* Ladyland (Scott). *Renfrew:* Glen, Misty Law (Scott).

E. Lowlands.—*Peebles:* Talla Linn (Macv.). *Selkirk:* Crossceugh Burn (Evans); Eldinhope Burn, R. (Macv.). *Roxburgh:* Bowden Hill, Melrose (Macv.). *Haddington:* Gullane Links, per. (M'And.). *Edinburgh:* Pentlands (M'And.).

S.E. HIGHLANDS.—*Fife and Kinross:* Largo Links, per. (Evans). *E. Stirling:* Redhill Glen, Gargunnock (Kids. and Stir.). *S. Perth:* Strathyre (Macv.); Tillicoultry Glen (Evans). *Mid Perth:* Ben Lawers, 1880 (West); Killin district, R.C. on the low ground, C. on the hills to 3400 ft. alt. (Macv.); Allt Dubh Ghalair (Cocks); Ben Dubh Craige, F. from 2100–2400 ft. alt. (Macv.); Ben Laoigh (Ewing); Achrioch Burn (Macv.); Clifton Burn, R.C. (Macv.); Ben Heasgarnich (Ewing). *N. Perth:* Glen Beg, Glen Shee, several places (Ferg.); Glen Tilt, 1500 ft. alt., per. (Ferg.); Glas Thulachan, 3300 ft. alt. (Ferg.); Dunkeld (Carr.); Glen Thaitneich (Ferg.).

MID E. HIGHLANDS.—*Forfar:* Clova (Ferg.); Den of Airlie (Ferg.). *S. Aberdeen:* Braemar (Stabl.).

N.E. HIGHLANDS.—*E. Inverness:* Laggantigown nr. Aviemore (Miss Macv.); Farr Rocks, Kincraig (Miss Macv.).

W. HIGHLANDS.—*Clyde Isles:* Lamlash (M'And.). *Dumbarton:* Ardlui, R. (Macv.); Manse Burn, Arrochar, U. (Macv.). *W. Inverness:* Moidart, F. (Macv.); Ardnamurchan, F. (Macv.); Sunart, C. (Macv.).

INNER HEBRIDES.—*S. Inner Hebrides:* Jura (Ewing). *Mid Inner Hebrides:* Nr. Tobermory (Kenn.). *N. Inner Hebrides:* Corrie, Broadford (Macv.); Mill Burn, Broadford, V.C. (Macv.).

LOWER N. HIGHLANDS.—*W. Ross:* Strome Ferry (Macv.); Strathcarron, F. (Macv.).

UPPER N. HIGHLANDS.—*E. Sutherland:* Ben Griam Mohr (Lillie). *Caithness:* Reisgill Burn (Lillie); Dunnet Links (Lillie); Scorrieclete Burn (Lillie).

SHETLAND.—Unst (Lillie).

var. LIBERTÆ (*Hüben.*)

S.E. HIGHLANDS.—*Mid Perth:* Achrioch Wood, Tyndrum, 1900 (Macv.); nr. Lochan na Larige (H. H. Knight).

ORKNEY.—Quoyawa, Hoy (Lillie).

var. PUMILA *Nees*

N.E. HIGHLANDS.—*Elgin:* Banks of the Findhorn above Sluie, 1848 (Croall).

LOWER N. HIGHLANDS.—*E. Ross:* Fairy Glen, Rosemarkie (Miss Macv.).

Lophozia bantryensis (*Hook.*) *Steph.*

Jung. bantryensis Hook.

Uncommon, but found in several counties from Kirkcudbright to Caithness. Most frequent on the hills in the Central Highlands. In the Lowlands it is rare. Grows in rather large tufts in wet ground at the side of rills, or in marshes and among wet rocks; occasionally straggling over moss tufts. Sterile plants common; perianths uncommon. Fruit not seen.

S.W. Lowlands.—*Kirkcudbright:* Crumingpark Burn, New Galloway (M'And.); Knocksheen Burn (M'And.).

N.W. Lowlands. — *Ayr:* Dumbarnie Links, Largs (M'And.).

E. Lowlands.—*Peebles:* Carlops (Evans). *Edinburgh:* Pentland Hills above Dreghorn, in well-head (Evans).

S.E. Highlands.—*Fife and Kinross:* Lomond Hills, in spring (Young). *Mid Perth:* Finlarig Burn, Killin (Macv.); Lochan na Larige (Macv.); Ben Lawers from 2700–3000 ft. alt., R. (Macv.); Ben Dubh Craige, 2400 ft. alt. (Macv.); Strath Braan, Inver, per. (M'In.). *N. Perth:* Glen Thaitneich, 3000 ft. alt. (Ferg.); Meal Vain, Glen Shee (Ferg.); nr. Spittal of Glen Shee (Barker); Ben Gulabin (Ew. and Young); Glen Beg, Glen Shee (Ew. and Young).

Mid E. Highlands. — *Forfar:* Balham Bog (Ferg.); Leytack (Ferg.); Clova (Ferg.); Craig Owl, Sidlaw Hills (Aimer).

W. Highlands. — *Dumbarton:* Arrochar Wood, R. (Macv.). *Argyll:* Nr. Leiter, Loch Awe, v.R. (Macv.). *W. Inverness:* Resipol Burn, Sunart, R. (Macv.).

Lophozia Kaurini (*Limpr.*) *Steph.*

Jung. Kaurini Limpr.

Known only from a single locality in Caithness, on a steep rock at the side of a stream; there is limestone in the immediate neighbourhood. This species should be expected to occur on some of the hills of Perthshire.

Upper N. Highlands.—*Caithness:* Ousdale, alt. *ca.* 500 ft., per., 1903 (Lillie).

Lophozia heterocolpa (*Thed.*) *Howe*

Jung. heterocolpa Thed.

This rare species has only been found in Mid Perth, and mostly on the hills where there is some limestone present.

S.E. Highlands.—*Mid Perth:* Craig-an-Lochain, Killin, alt. 1700 ft., with *Bryum pseudo-triquetrum*, *Mnium orthorrhynchum*, *M. punctatum*, *Swartzia montana*, *Hylocomium splendens*, 1901 (Macv.): Cam Creag, Killin, with *Marchantia polymorpha*, 1909 (D. A. Jones): Ardeonaig, Killin, 1909 (S. J. Owen).

Lophozia obtusa (*Lindb.*) *Evans*

Jung. obtusa Lindb.

This is a very rare species in Scotland, though it will doubtless be bound to have a wider distribution when better known. At present it has only been found in the Breadalbane mountains and in the West Highlands. Its usual locality is among alpine species, and it probably has been found to about 3000 ft. alt., but in one place on the west coast it occurs close to sea-level. The Scottish specimens are sterile.

S.E. Highlands.—*Mid Perth:* Ben Lawers, among *Marchantia polymorpha*, 1909 (D. A. Jones and H. H. Knight).

W. Highlands.—*Dumbarton:* Bank in Arrochar Wood, nr. sea-level, ♂, with *Dicranum majus* and *Plagiothecium undulatum* (Macv.). *W. Inverness:* Ben Gaire, Moidart, alt. *ca.* 1700 ft. on rock ledge, with *Anastrepta orcadensis*, 1898 (Macv.): Ben Nevis, alt. *ca.* 2000 ft., among *Hypnum Schreberi*, 1909 (H. H. Knight).

Lophozia ventricosa (*Dicks.*) *Dum.*

Jung. ventricosa Dicks.

One of the most generally distributed and common species both on the low ground and on the hills. It is rather uncommon in the region of cultivation in both West and East Lowlands, but is common in the subalpine region, and occasionally very common, as in the Upper Clyde and in part of the Upper Tweed districts. It continues un-

common in the low-lying districts of Fife and the East Highlands at some distance from the hills. Over the remainder of the country it is common, including Orkney and Shetland. It ascends to the summits of the hills in Perthshire and to the summit of Ben Nevis. With such a common species it is difficult to state where it is most abundant, but in the subalpine region of the centre of the Lowlands it is probably more in evidence than in any other district.

It is found in all kinds of soil and situation, and varies in colour, though most commonly of a pale green, but becoming brown in dry places. It occurs in compact tufts or as scattered stems among other species. Perianths are frequent but not very common. Fruit, which is mature from April to June, is rather uncommon. Gemmæ are nearly always present.

Lophozia porphyroleuca is treated as a variety, as the specimens were mostly without perianths, and the distinctive character of the mouth of the perianth, as recently given by Schiffner, was not taken into account at the time of examination. This plant is uncommon in the West Lowlands, rare in the East Lowlands, and frequent but not common in the Highlands.

It is usually found on decaying wood and roots, especially in the Lowlands and East Highlands, but frequently also on peat when in the West and North Highlands. The plant about the summits of the Perthshire hills and the Shetland specimens seemed to be more frequently referable to this plant than to *L. ventricosa*.

S.W. Lowlands. — *Dumfries:* Whitecombe (Johns.); Moffat, F. (Miss Macv.); Langholm, per. (Ewing); Sanquhar district, F. (Macv.); Crichope Linn, C. (Macv.). *Kirkcudbright:* Bowwood (M'And.); Benniguirea (M'And.); Kippford, per. (Ham.); Bennan Hill (M'And.); Glen Trool (Macv.). *Wigtown:* Portpatrick (M'And.); Knowe (Ewing); nr. New Luce, per. (Ewing).

N.W. Lowlands.—*Ayr:* Mochra Hill (Ewing); Largs (Ewing); Fairlie (Ewing); Glen Afton, U. (Macv.); Ladyland (Scott). *Renfrew:* Gourock (Ewing); Loch Thom, ♂ (Ewing); Lochwinnoch (Ewing); Cloch (West). *Lanark:*

Wilsontown (Ewing); Possil, cfr. (Ewing); River Calder (Ewing); Carstairs Moss, v.c. (Macv.); Tinto, f. (Macv.); Crawford, Elvanfoot, and Leadhills districts, v.c. to summit of Lowthers (Macv.).

East Lowlands.—*Peebles:* Cowie's Linn (Evans); nr. Carlops (Evans); Leadburn (Evans); Upper Tweed valley, c., often v.c. (Macv.). *Selkirk:* Howden (Evans); Tushielaw (Evans); Glenkinmon Burn, on wall (Macv.); Lindean, roadside (Macv.). *Roxburgh:* Abbotsford, roadside (Macv.); Eildon Hill, c. above 1000 ft. alt. (Macv.). *Berwick:* Longformacus (Miss Macv.); Cockburnspath (M'And.); Seenes Law (Evans). *Haddington:* Oldhamstocks (Evans); Lammer Law, several places (Evans); N. Berwick Law (M'And.); Garleton Hill, per. (Evans); Dunbar Common (Evans). *Edinburgh:* Corstorphine Hill (A. Murr.); Glencorse Reservoir (Evans); Ravelrig (Evans); Hillend Hill, per. (Evans); Torduff, ♀ (Evans); Clubbiedean (Evans); Caerketton (Evans); Currie Moor (Evans); Nether Habbie's Howe (Evans); Balerno Moss, c. (Macv.); Newbattle Abbey (Evans); Baads (Ewing). *Linlithgow:* Drumshoreland (Evans); Fauldhouse Moor (Evans); Dalmeny, per. (M'And.); do., ♂ (Evans).

S.E. Highlands.—*Fife and Kinross:* Lomond Hills, several places (Young); Raith (Young); Orrock Hill (Young); Cullalo, per. (Evans); Dunearn Hill (Young); Kinghorn, ♀ (M'And.); St Andrews Bay, per. (Aimer); Isle of May, ♀ (G. West); do. per. (Evans). *E. Stirling:* Earl's Burn Reservoir (K. & S.); Bannockburn (M'And.); Ridgehead Moss (Evans); Murrayshall, per. (Evans). *S. Perth:* Aberfoyle (Ewing); Trossachs (Ewing); Strathyre (Macv.); Menstrie Glen (Evans); Tillicoultry Glen (Evans). *Mid Perth:* Nr. Methven (Ferg.); St Magdalenes nr. Perth (Meld.); Ben Lawers district, c., ascends to alt. 4000 ft. on Ben Lawers (Macv.); Tyndrum district, c., Ben Laoigh, alt. 2300 ft. (Macv.); Coire Ardran (Macv.); summit of Shichallion (Coles); Loch Rannoch (Carr.). *North Perth:* Meal Vain, Glen Shee (Ferg.); Ben Gulabin, and Glen Beg, Glen Shee (Ewing and Young); Glen Thaitneich (Ewing and Young); Dunkeld (M'In.); Blair Athole (Holmes).

Mid E. Highlands.—*Forfar:* Auchphersie (Ferg.); Scotstoun, per. (Ferg.); Clova, per. (Aimer). *Kincardine:*

Mount Shade (Sim); Den of Garol (Sim); Invery, per. (Sim); Tillylair (Sim); Kerloch (Sim); Commonty (Sim); Feugh Rocks (Sim); Gateside (Sim); nr. Stonehaven, several places, per. (M'And.). *S. Aberdeen:* Birse (Sim); Ballochbuie (Stabl.); Lochnagar (Stabl.); Balmoral (Sim). *N. Aberdeen:* Mormond Hill (Ewing).

N.E. Highlands. — *Elgin:* Linn of the Shogle, 1848 (Croall); Glen Beg nr. Grantown (Miss Macv.); Lochan Dorb (Miss Macv.). *E. Inverness:* Coire Glas, Glengarry (How.); Carn Dearg, Aviemore (Macv.); Loch Vaa, per. (Miss Macv.); Lethendry Hill (Miss Macv.); Carr Bridge (Miss Macv.); about Lochan Dorb, Nairn (Miss Macv.); Glenferness (Miss Macv.); Kincraig, per. (Miss Macv.); Fort Augustus (Macv.).

W. Highlands.—*Kintyre:* Campbeltown (Ewing); Tarbert (Ewing); Ronachan (Macrae); Ardrishaig (Ewing). *Clyde Isles:* Corrie, Arran (Ewing); Loch Ranza, v.c., cfr. (Macv.). *Dumbarton:* Ardlui, c. (Macv.); Arrochar (Macv.); Tarbert (Macv.); Loch Humphrey (Ewing); Garscube (Campb.). *W. Stirling:* Campsie, ♂ (Ewing); Inversnaid (Macv.); Strathblane (Campb.). *Argyll:* Ben More, Loch Eck (A. Murr.); Dunoon (Ewing); nr. head of Loch Long, ♂ (Macv.); Glencoe (Macv.); Oban (Ewing); Loch Tulla, c. on stumps, etc. (Macv.); Ben Doureann (Macv.); Lochan Bhe (Macv.); Ben Arthur, r.c. (Macv.). *W. Inverness:* Glenfinnan (Carr. *cf.* Pears. Hep. Brit., p. 329); Moidart, c. (Macv.); Ardnamurchan, c. (Macv.); Sunart, c. (Macv.); Ben Nevis to alt. 4400 ft. (Macv.); Morar (West).

Inner Hebrides.—*S. Inner Hebrides:* Ardbeg, Islay, per. (Gilm.); Sgor Bynachain, alt. 1000 ft. (Gilm.); Bridgeend (Gilm.). *Mid Inner Hebrides:* Tobermory (Macv.); L. Mishnish (Macv.); Ben More (Kenn.). *N. Inner Hebrides:* Broadford district, c. (Macv.).

Outer Hebrides. — Barra (Ewing); Tarbert, several places (West); Balallan (West).

Lower N. Highlands.— *W. Ross:* Strathcarron, v.c. and cfr. (Macv.); Strome Ferry (Macv.); Gairloch (Miss Macv.). *E. Ross:* Ben Wyvis, 1864 (How.); Loch Luichart (West); Achnasheen, v.c. (Macv.).

Upper N. Highlands.—*E. Sutherland:* Strath Ullie

(Lillie); The Ord (Lillie); Helmsdale, ♂ (Lillie). *W. Sutherland:* Strath Halladale (Lillie); Ben Clibreck, alt. 3000 ft. (Lillie). *Caithness:* Rumster (Lillie); North Watten Moss (Lillie); Borgue Hill (Lillie); Morven (Lillie); Kensay (Lillie); Ousdale (Lillie).

Orkney.—Hoy (West); Stromness, per. (West); Kirkwall, several places (West); Eday (Lillie); Stennis (Lillie).

Shetland.—Lerwick (Sim); Yell (Sim); Clousta (Grieve); Uni Firth (Grieve); Bressay (West); Scalloway (West); Fair Isle (Miss Skene); Uyea (Beeby); Unst and Whalsey, several places (Lillie); Weisdale (Beeby).

var. porphyroleuca (*Nees*)

S.W. Lowlands.—*Dumfries:* Crawick W. (Macv.); Wanlockhead (Macv.).

N.W. Lowlands.—*Lanark:* Elvanfoot (Macv.).

E. Lowlands.—*Peebles:* Peat-moss nr. Leadburn (Evans); Carton Burn, alt. 1200 ft., per. (Macv.); Tweedsmuir (Macv.).

S.E. Highlands. — *Fife and Kinross:* Crail, cfr. (M'And.).

W. Highlands.—*Kintyre:* Caolisport (Ewing). *Clyde Isles:* Loch Ranza (Macv.). *W. Stirling:* Inversnaid (Macv.). *W. Inverness:* Moidart, per. (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Kildalton Woods, per. (Ewing).

Upper N. Highlands.—*E. Sutherland:* Glen of Loth (Lillie). *W. Sutherland:* Ben Laoghal (Lillie); nr. Durness (Lillie). *Caithness:* Benacheilt (Lillie).

Orkney.—Hoy (Lillie).

Lophozia guttulata (*Lindb. et Arn.*) *Evans*

Jung. guttulata Lindb. et Arn.

Only known from one locality in the East Highlands. This plant is of an eastern rather than a western type of distribution, and is not likely to be found in many parts of our country. It seems always to be confined to decaying wood.

Mid E. Highlands. — *S. Aberdeen:* Ballochbuie, on decaying wood with *Nowellia curvifolia* and *Bleph. trichophyllum*, 1884 (Stabl.).

Lophozia longidens (*Lindb.*) *Macoun*

Jung. longidens Lindb.

This species, as with the preceding, is of an eastern Continental type of distribution, and, as is to be expected, is almost confined to the east and central parts of Scotland. It has also been found very sparingly in two localities on the western watershed, but one of these is a considerable distance inland. Its range is from nearly sea-level in the subalpine region to about 2200 ft. alt.

S.E. Highlands.—*Mid Perth:* Am Binnean, on wood, 1903 (Ewing); Meol Garbh, Rannoch, alt. *ca.* 2200 ft. (W. E. Nicholson).

Mid E. Highlands.—*S. Aberdeen:* Glen Muick, 1876 (Sim).

N.E. Highlands. — *E. Inverness:* Laggantigown nr. Aviemore, per., 1903 (Miss Macv.).

W. Highlands.—*Argyll:* Ben Doureann, among *Anastrepta orcadensis*, 1909 (H. H. Knight). *W. Inverness:* Glen Stron nr. Fort William, 1909 (H. H. Knight).

Lophozia alpestris (*Schleich.*) *Evans*

Jung. alpestris Schleich.

Very rare in the Lowlands, having been found only in two localities on the Southern Uplands. Generally distributed over the Highland region in the mountainous parts, ascending to the summits of the hills, and rarely seen below 1800 ft. alt. It is an uncommon species in Scotland, more so than would be expected from its Continental distribution. It seldom occurs unmixed, being usually among other species, and mosses, on moist soil or rock. It is apparently in greater quantity on the Breadalbane and Cairngorm ranges than in the Western Highlands. In the last district it is rare near the coast. It has not been found in the Inner Hebrides, though this is no doubt due in a great measure to the want of suitable conditions near the summits of the higher hills. Perianths are very rare, and fruit has not been seen by the author.

The var. *gelida* is difficult to distinguish from the type, and appears to be only a form of it.

S.W. Lowlands.—*Dumfries:* Nr. Moffat (M'And.). *Kirkcudbright:* Bennan Hill, New Galloway, alt. *ca.* 1500 ft. (M'And.).

S.E. Highlands.—*S. Perth:* Am Binnean, nr. summit (Evans). *Mid Perth:* Killin Hills, f. to 4000 ft. alt. (Macv.); Ben Heasgarnich (Ewing): Ben Dubh Craige, at summit (Macv.); Craig Mohr (Ewing); Coire Ardran, on boulders, alt. 1600–2000 ft. (Macv.). *N. Perth:* Glas Thalachan, alt. 3000 and 3200 ft. (Ferg.); Glen Beg, Glen Shee (Ferg.); wall, Spittal of Glen Shee (Ew. and Young).

Mid E. Highlands.—*Forfar:* Clova (Ferg.); Camlochan (Ew. and Young). *S. Aberdeen:* Ben MacDhui (Dickie); do. (Stabl.); Lochnagar (Sim); Coire Ceanmor (Ewing); do. (West).

N.E. Highlands.—*Banff:* Head of Glen Avon, 1855 (Croall). *E. Inverness:* Cairn Gorm, summit (Macv.); Braeriach, alt. 2500 ft. (Wilson and Wheldon).

W. Highlands.—*Argyll:* Ben Cruachan, alt. 1700 ft. (Macv.); Ben Doureann (Ew. and Macv.). *W. Inverness:* Ben Nevis, 1875 (Whitehead); do., several places to alt. 4400 ft. (Macv.); Choir Arder (Ferg.); Glen Nevis (Macv.); Ben Nevis (Macv.); Moidart, r. (Macv.).

Lower N. Highlands.—*W. Ross:* Glasven, alt. 2200 ft. (Macv.). *E. Ross:* Above Achnasheen, alt. *ca.* 800 ft. (Macv.).

Upper N. Highlands.—*E. Sutherland:* Ben Griam Mohr (Lillie). *W. Sutherland:* Ben Clibreck, above 2000 ft. alt. (Lillie). *Caithness:* Morven (Lillie).

Shetland.—Saxa Vord, Unst (Lillie).

var. gelida (*Tayl.*)

S.E. Highlands.—*Mid Perth:* Ben Lawers (Macv.); Am Binnean (Young). *N. Perth:* Glen Shee (Ferg.).

Mid E. Highlands.—*Forfar:* Camlochan (Ew. and Young). *S. Aberdeen:* Loch Ceanmor (Hunt); Meal Odhar (Ew. and Young); Lochnagar (Sim). *E. Inverness:* Cairn Gorm, alt. 3200 ft. (Macv.).

W. Highlands.—*Argyll:* Coire Creachainn, Ben Cruachan, alt. *ca.* 1800 ft., on boulders with *Gymn. obtusum* (Macv.). *W. Inverness:* Roshven, Moidart (Macv.); Ben

Cairc, Moidart, alt. 1900 ft., on bare peat (Macv.); Ben Nevis, among *Gymn. obtusum*, alt. 3300 ft. (Macv.).

Outer Hebrides.—Summit of Clisham (West).

Upper N. Highlands.—*Caithness:* Morven (Lillie).

Lophozia Wenzelii (*Nees*) *Steph.*

Jung. Wenzelii Nees

Has only been found in wet ground on two of the highest hills. One of the Ben Nevis localities was on or near the summit plateau.

Mid E. Highlands.—*S. Aberdeen:* Ben MacDhui, 1880 (West).

W. Highlands.—*W. Inverness:* Ben Nevis, above 3500 ft. alt., 1880 (West); do., 1909 (H. H. Knight).

Lophozia bicrenata (*Schmid.*) *Dum.*

Jung. bicrenata Schmid.

Widely distributed from Dumfries to Shetland, but uncommon. It is rare in the Lowlands, uncommon in the East Lowlands and Fife, but is frequent in some parts of the Eastern Highlands. It is uncommon to rare in the West and North Highlands, and has not been found in the Hebrides. Being a small plant and easily overlooked, its distribution is not well known, but it shows a preference for the eastern side of the country. It is a low-ground species, though it has been found to about 1500 ft. alt. in Mid Perth. It forms reddish-brown small patches on dry soil on banks and on turf-covered walls. Perianths are usually present; fruit, which is mature from May to July, is not common. Gemmæ are very commonly present.

S.W. Lowlands. — *Kirkcudbright:* New Galloway (M'And.). *Wigtown:* Portpatrick (M'And.).

E. Lowlands.—*Peebles:* Carton Burn, alt. 950 ft. (Macv.); Tweedsmuir, cfr. (Macv.). *Roxburgh:* Eildon Hill, cfr. (Macv.). *Berwick:* Nr. Cockburnspath (M'And.). *Haddington:* Nr. Tantallon Castle (M'And.); Gullane Links (M'And.). *Edinburgh:* Corstorphine Hill, cfr. (Evans); nr. Bonally Reservoir (M'And.). *Linlithgow:* Craigiehall Woods (M'And.).

S.E. Highlands.—*Fife and Kinross:* Lomond Hills (Young); Binns Quarry (Evans). *Mid Perth:* Killin, on rocky bank (Macv.); Kiltyrie, on bank (Macv.); turf wall, roadside to Lochan an Larige (Macv.); Ben Ghlas, on boulder, alt. *ca.* 1500 ft. (Macv.); nr. Inver, on wall (M'In.). *N. Perth:* Glen Beg, Glen Shee (Ew. and Young); Ben Gulabin (Ew. and Young).

Mid E. Highlands.—*Forfar:* Sidlaws, cfr. (Fulton); Craig Owl, Sidlaws, cfr., alt. *ca.* 1200 ft. (Aimer). *Kincardine:* Scolty, 1875 (Sim); Bogindreep (Sim); Dalfro (Sim). *S. Aberdeen:* Ballochbuie (Stabl.).

N.E. Highlands.—*E. Inverness:* Above Lochan Dorb, Nairn, on roadside (Miss Macv.).

W. Highlands.—*Kintyre:* Nr. Lochgilphead (Ewing). *Dumbarton:* Arrochar, on turf wall (Macv.). *Argyll:* Loch Tulla, on bank (Macv.); Lochan Bhe, on banks (Macv.). *W. Inverness:* Moidart, v. (Macv.); Spean Bridge, on bank (Macv.).

Lower N. Highlands.—*W. Ross:* Strathcarron, on gravel bank (Macv.). *E. Ross:* Achnasheen, on a boulder (Macv.).

Upper N. Highlands.—*Caithness:* Badlipster (Lillie).

Shetland.—Unst (Sim).

Lophozia excisa (*Dicks.*) *Dum.*

Jung. excisa Dicks.
Jung. capitata Hook.

Widely distributed but uncommon from Kirkcudbright to Caithness. Its distribution is not yet well known, not only from its generally small size but also from the var. *Limprichtii* being confused with *L. bicrenata*, the two being indistinguishable in the field when sterile. It is rare in the West Lowlands; in this district it is more frequent in the Upper Clyde valley than in the other parts. It is less uncommon in the East Lowlands, and has been found in greater quantity here than in any other part of Scotland. It is very rare in the West Highlands and Hebrides, and this appears also to be the case in the North Highlands. Its distribution has an eastern tendency, in common with the two other members of this group.

The type grows in pale-green tufts on somewhat sheltered

banks and old walls, the var. *Limprichtii* in thin reddish patches on dry soil on banks. Perianths are usually present, and fruit, which is mature from March to October, is common. Gemmæ are almost always present.

S.W. Lowlands.—*Kirkcudbright:* Garroch Wood, per. (M'And.).

N.W. Lowlands.—*Renfrew:* Cloch (Macv.).

E. Lowlands.—*Peebles:* Rachan, on wall, cfr., f. (Macv.). *Selkirk:* Wall, Galashiels, cfr. (Macv.); nr. Clovenfords, cfr. (Macv.). *Roxburgh:* Melrose, cfr. (Macv.). *Berwick:* Kelhope Glen, on turf wall, cfr. (Evans). *Haddington:* Gosford Bay, per. (M'And.). *Edinburgh:* Auchendinny, cfr. (M'And.); Torduff Reservoir, side of wall, per. (M'And.); Blackford Hill, per. (M'And.). *Linlithgow:* Nr. Bathgate, cfr. (Evans); Dalmeny Park, cfr. (Evans); E. of Forth Bridge (M'And.); Cramond Bridge (M'And.); Craigiehall Wood, per. (M'And.).

S.E. Highlands.—*Fife and Kinross:* Orrock Hill, at the base, on old wall, per. (Young); nr. Dunearn, on old wall, per. (Evans).

Mid E. Highlands.—*Kincardine:* Gateside, Strachan, per., 1880 (Sim); Tillylair, with *Lep. reptans* (Sim). *E. Inverness:* Laggantigown nr. Aviemore, cfr. (Miss Macv.).

W. Highlands.—*W. Inverness:* Moidart, on old wall, per. (Macv.); Glen Nevis, cfr. (West).

Inner Hebrides.—*Mid Inner Hebrides:* Nr. Tobermory, on old wall, per. (Macv.).

Lower N. Highlands.—*E. Ross:* Nr. Fortrose, cfr. (Miss Macv.).

Upper N. Highlands.—*Caithness:* Dunbeath Strath, per. (Lillie).

var. Limprichtii (*Lindb.*)

N.W. Lowlands.—*Lanark:* Roadside, Crawford (Macv.); Elvanfoot, on bank (Macv.).

E. Lowlands.—*Peebles:* Bank nr. Mossfennan (Macv.).

Lophozia cylindracea *Dum.*

Jung. socia Nees

Has been found in a few places in the East and in the North Highlands, generally on the low ground. It does

not appear to ascend the hills to above the lower slopes. Perianths are always present. It occurs as scattered stems, frequently among *Lophozia quinquedentata*.

S.E. Highlands.—*N. Perth:* Ben Gulabin (Ew. and Young).

Mid E. Highlands.—*S. Aberdeen:* Ballochbuie Forest above Balmoral, on decaying trunks, cfr. (Stabl.).

N.E. Highlands.—*E. Inverness:* Eskadale nr. Beauly, among *Dicranum*, 1847 (Grev.); Carn Dearg nr. Aviemore, with *Loph. quinquedentata* and *Sphen. minutus* (Macv.).

Upper N. Highlands.—*W. Sutherland:* Strath Halladale, with *Loph. Floerkii* (Lillie).

Lophozia incisa (*Schrad.*) *Dum.*

Jung. incisa Schrad.

Generally distributed and frequent over the whole of the country, except in the cultivated region. It is rare on the low-lying moors of the Lowlands, but is frequent on peaty banks of the Southern Uplands from 1200 ft. alt. Is frequent over the whole of the Highlands, being most plentiful on the low-lying moors, though also frequent on the hills. It is rather common over most of the West Highlands, and is sometimes very common. On the higher parts of the hills in that province it is rare. It has been found to 3600 alt. on Ben Nevis, to 3500 ft. alt. in Mid Perth, and to 3200 ft. alt. in the Cairngorms.

It occurs as flat blue-green patches on moist peaty banks and moors, and on stumps. In the last position it is sometimes very common in the West Highlands. Perianths are frequent, but not common. Fruit, which is mature in June, is rare.

S.W. Lowlands.—*Dumfries:* Lochar Moss, 1840 (Gray); Penton Linns (Scott); Whitecombe (Johns.); Langholm (Ewing); Sanquhar Moor, R. (Macv.). *Kirkcudbright:* Bennan Hill, New Galloway, per. (M'And.). *Wigtown:* Nr. New Luce (Ewing).

N.W. Lowlands.—*Ayr:* Barskimming Moor (Scott). *Renfrew:* Misty Law (Scott). *Lanark:* Marsh, Kenmuir

(Hopk. *cf.* Fl. Glott., p. 140); Clydeside (Newton); Lowther Hills, F. from 1700 ft. upwards (Macv.).

E. Lowlands.—*Peebles:* Carton Burn, alt. 1200–1300 ft. R.C. (Macv.); Logan Water, alt. 1260 ft., C. (Macv.); Tweedsmuir, F. above 950 ft. alt. (Macv.). *Selkirk:* Between Tushielaw and St Mary's Loch (Evans). *Roxburgh:* Eildon Hill, alt. 1200 ft., R. (Macv.). *Haddington:* Lammer Law (Evans). *Edinburgh:* Pentland Hills, 1824 (Grev. Herb.); Logan Burn (Evans); Caerketton Hill (Evans); Torduff Reservoir (M'And.); Nether Habbie's Howe (Evans).

S.E. Highlands. — *Fife and Kinross:* Glen Burn (Evans); Keil's Den, per. (M'And.); Tents Muir (Young). *E. Stirling:* Ridgehead Moss (Evans). *S. Perth:* Callander, 1824 (Grev.); Aberfoyle (Evans); Trossachs (Ewing); Tillicoultry Glen (Evans). *Mid Perth:* Crianlarich (Barker); Ben More, ♂ (Dixon); Am Binnean, near summit (Evans); Ben Voirlich, summit (Evans); Ben Heasgarnich, per. (Ewing); Ben Laoigh (Ewing); Ben Dubh Craige (Macv.); Achrioch Wood, Tyndrum, C. on stumps (Macv.); Killin district, R.C. (Macv.); Coire Ardran, C. (Macv.). *N. Perth:* Glas Thalachan, alt. 2800 and 3200 ft. (Ferg.); Glen Tilt (Ferg.); Carn-nan-Sac, Glen Shee (Ewing); King's Seat (Ferg.); Glen Beg, Glen Shee (Barker); Ben Gulabin (Ewing and Young); Glen Thaitneich (Ewing and Young).

N.E. Highlands. — *Forfar:* Clova Mountains, 1824 (Grev.); Law Hill, Dundee, 1840 (Gard.); Arbroath (Ferg.); Glen Dole (Gard.); Camlochan (Ewing and Young); Sidlaws (Aimer). *Kincardine:* Den of Garol (Sim); Dalfro, per. (Sim); Bogindreep (Sim). *S. Aberdeen:* Lochnagar (Sim); Glen Beg, Braemar (Stabl.); Braemar (Holmes); Coire Ceanmor (Ewing and Young).

N.E. Highlands.—*Elgin:* Lochan Dorb (Miss Macv.). *E. Inverness:* Cairn Gorm, alt. 3200 ft. (Macv.); Aviemore district, F. (Macv.); Carr Bridge, several places (Miss Macv.); Braeriach, alt. 2300 ft., *forma* (Wilson and Wheldon.)

W. Highlands. — *Kintyre:* Campbeltown (Ewing); Ronachan (Macrae); nr. Tarbert (Ewing). *Clyde Isles:* Loch Ranza, U. (Macv.). *Dumbarton:* Ardlui, U. (Macv.). *Argyll:* Puck's Glen (A. Murr.); Loch Awe district, R. (Macv.); Ben Cruachan (Macv.); Ben Udlaith, R.C. from

alt. 1900–2400 ft., also cfr. (Macv.); Ben Doureann, v.c. (Macv.); Loch Tulla, v.c. on stumps and banks (Macv.); Ben Arthur, alt. 1600–2600 ft., r.c. (Macv.); Kentallen (Macv.); Glencoe (West). *W. Inverness:* Ben Nevis, alt. 3000 ft. (West); do., alt. 3600 ft. (Macv.); Glen Nevis, alt. 1900 ft. (Macv.); Moidart, r.c. (Macv.); Ardnamurchan (Macv.); Sunart (Macv.).

Inner Hebrides.—*Mid Inner Hebrides:* Loch Mishnish (Macv.); Allt na Searmoin (Kenn.). *N. Inner Hebrides:* Mill Burn, Broadford, r. (Macv.).

Outer Hebrides.—Tarbert (West); Balallan, per. (West).

Lower N. Highlands.—*W. Ross:* Kyle, r.c. (Macv.); Strome Ferry (Macv.); Strathcarron, f. (Macv.); Loch Maree (Miss Macv.); Gairloch (Miss Macv.). *E. Ross:* Achnasheen (Macv.).

Upper N. Highlands.—*W. Sutherland:* Ben Laoghal (Lillie). *Caithness:* North Watten Moss (Lillie); Langwell (Lillie); Ousdale (Lillie).

Orkney.—Eday (Lillie); Kirkwall, several places (West).

Shetland.—Bousta (Sim); Uni Firth (Grieve).

Lophozia quinquedentata (*Huds.*) *Cogn.*

Jung. quinquedentata Huds.
Jung. Lyoni Tayl.

Generally distributed over the subalpine parts of the country from Dumfries to Shetland. It is uncommon in the Lowlands, though frequent in a few of the better characterised subalpine regions, as in Kirkcudbright and the Talla Linns: otherwise it is found sparingly on isolated hills and in small quantity over the whole range of the Southern Uplands, usually from 1200 ft. alt. upwards. Over almost the whole of the Highlands it is a common species, being much the most frequent member of the *barbatæ* group. It is most frequent in the lower subalpine region, but is also rather common on the hills, and ascends from sea-level to 4000 ft. alt. in Mid Perth, 3900 ft. alt. on Ben Nevis, and to 3000 ft. alt. in Sutherland. It is common in the Inner Hebrides and has been found in some quantity in Orkney, but appears to be uncommon in Shetland. It grows in dark yellow-green tufts, or mixed with mosses,

on moist banks and old walls, tree stems and rock ledges. When in the last position on the hills it is seldom found unmixed. On the hills it is also occasionally found in marshes. Perianths and male plants are common; fruit, which is mature from late in June to September, is frequent. Gemmæ are uncommon.

S.W. Lowlands.—*Dumfries:* Dumfries, 1841 (Cruicks.); Penton Linns, on limestone rocks (Scott). *Kirkcudbright:* Nr. Dalskaith, 1840 (Gray); New Galloway, ♂, *sub nom. L. lycopodioides* (M'And.). *Wigtown:* Nr. New Luce (Ewing).

N.W. Lowlands.—*Ayr:* Largs (Ewing); N. of Ladyland (Scott). *Renfrew:* Lochwinnoch, ♂ (Ewing); Loch Thom (Ewing). *Lanark:* Banks of the Clyde (Lyon *cf.* Pears. Hep. Brit., p. 341); Leadhills (Lyon); do., on Green Lowther, alt. 1700 ft., R. (Macv.); Falls of Clyde (Young); Lousie Wood Law, alt. 1500 ft., R. (Macv.).

E. Lowlands.—*Peebles:* Rachan, on wall, per. and ♂, R.C. (Macv.); Carton Burn, alt. 1200 ft., V. (Macv.); Logan Water, alt. 1200 ft. (Macv.); Talla Water, F. (Macv.). *Selkirk:* Banks of Yarrow, Bowhill, per. (Evans); Glenkinnon Burn, on wall, ♂ and per., alt. *ca.* 500–600 ft. (Macv.). *Roxburgh:* Eildon Hill, alt. 1700 ft., R. (Macv.). *Berwick:* Threeburnfoot (R. Renton); Cockburnspath (M'And.); Longformacus (Miss Macv.). *Haddington:* North Berwick Law (M'And.); Garleton Hill (Evans); Gullane (M'And.). *Edinburgh:* Torduff, ♂ (Evans); Bonally Burn (M'And.); Loganlea Reservoir (Evans); Clubbiedean, per. (M'And.); Nether Habbie's Howe (Evans); Corstorphine Hill, per. (A. Murr.). *Linlithgow:* Riccarton Hills, per. (Evans); E. of Cocklerue, per. (Evans).

S.E. Highlands.—*Fife and Kinross:* West Water, 1842 (Gard.); St Andrews (How.); Lomond Hills, ♂ (Young); Aberdour, ♂ (Evans); Falkland Woods, per. (Evans); Glen Queich, per. (Evans); nr. Newport (Aimer); Auchtertool, per. and ♂ (Young). *E. Stirling:* Gargunnock Burn (Croall); Gargunnock Hill (K. & S.); Boquhan Glen (K. & S.); Glengyle (K. & S.). *S. Perth:* Strathyre, cfr. (Macv.); Aberfoyle, ♂ (Evans); Trossachs (Ewing); Menstrie Glen (Evans); Tillicoultry Glen, per. (Evans). *Mid*

Perth: Ben Lawers (Barker); Killin district, R.C., both on low ground and on the hills to 4000 ft. (Macv.); Creag Mhor (Ewing); Tyndrum district, F. (Macv.); Ben Dubh Craige, F. to 2800 ft. alt. (Macv.); Ben Laoigh (Ewing); do., C. (Macv.); Coire Ardran (Macv.); Glen Farg (Meld.); Craig Vinean (M'In.). *N. Perth:* Dunkeld (Carr.); Craighall (Ferg.); Meal Vain, Glen Shee (Ferg.); Glen Gulabin (Ewing and Young); Glen Thaitneich (Ewing and Young).

MID E. HIGHLANDS.—*Forfar:* Reeky Linn, 1843 (Gard.); do., per., 1862 (Croall); do., 1906 (Aimer); Ravine of the Mourin (Croall); Auchphersie Burn, per. (Ferg.); Glenogil, alt. 1200 ft. (Ferg.); Camlochan (Ewing and Young); Fern (Ferg.); Clova, several places (Ferg.). *Kincardine:* Den of Garol, ? (Sim); Tillylair (Sim); Dalfro (Sim); Blackhall (Sim). *S. Aberdeen:* Ben MacDhui, 1856 (Croall); Braemar (Croall); Balmoral Forest (Stabl.).

N.E. HIGHLANDS.—*Banff:* Head of Glen Avon, 1856 (Croall). *E. Inverness:* Cawdor, Nairn, 1857 (Croall); Aviemore district, C. and per. (Macv.); Invercannich, per. (Cocks); Glen Tromie (Miss Macv.); Braeriach, alt. 2800 ft. (Wilson and Wheldon).

W. HIGHLANDS.—*Kintyre:* Without further locality (Ewing); between Ardrishaig and Tarbert (Ewing). *Clyde Isles:* Loch Ranza, U. (Macv.). *Dumbarton:* Ardlui (Macv.); Arrochar (Macv.). *W. Stirling:* Campsie Glen (Dickie); Inversnaid (K. & S.). *Argyll:* Coire Athoich, Ben More (A. Murr.); Glen Nant, U. (Macv.); Loch Awe district, C. (Macv.); Ben Doureann, C. (Macv.); Lochan Bhe (Macv.); Kentallen, per. (Macv.); Loch Tulla (Macv.); Glencoe (Macv.). *W. Inverness:* Moidart, C. (Macv.); Ardnamurchan, C. (Macv.); Sunart, C. (Macv.); Glen Nevis (Macv.); Ben Nevis to 3900 ft. alt. (Macv.).

INNER HEBRIDES.—*Mid Inner Hebrides:* Tobermory (Ewing); Dervaig (Macv.); Ben More (Kenn.); Glenforsa (Kenn.); Allt na Searmoin (Kenn.). *N. Inner Hebrides:* Storr Rock (Ewing); Broadford district, F. (Macv.).

OUTER HEBRIDES.—Tarbert (West).

LOWER N. HIGHLANDS.—*W. Ross:* Strathcarron, U. (Macv.); Loch Maree (Miss Macv.). *E. Ross:* Achnasheen (Macv.); Loch Luichart (West).

Upper N. Highlands.—*E. Sutherland:* Nr. Rogart (Lillie); nr. The Mound (Lillie). *W. Sutherland:* Farr (Lillie); Strath Naver (Lillie); Ben Clibreck, alt. 3000 ft. (Lillie). *Caithness:* Morven (Lillie); Dorrery (Lillie).

Orkney.—Ward Hill, Hoy, several places (Lillie).

Shetland.—Muckle Heog Cairns, Unst (Lillie); Loch of Cliff, Unst, among *Sphagnum* (Lillie).

Lophozia barbata (*Schmid.*) *Dum.*

Jung. barbata Schmid.

Widely distributed from Dumfries to Shetland, but uncommon. It is rare in the Lowlands, being rather less so on the east side than on the west. It is most frequent in the East Highlands, though still uncommon. Is rare in the West Highlands, very rare in the Inner Hebrides, and has not been found in the Outer Hebrides. It is also rare in the North Highlands, has not been found in Orkney, and has only once been gathered in Shetland. It is a low-ground plant, though ascending to 2700 ft. alt. in Mid Perth and to 1600 ft. alt. in the Inner Hebrides.

Grows in thick patches by itself, or mixed with mosses about the base of damp walls and on banks, the latter being frequently dry. Perianths are somewhat rare, and fruit has not been seen.

S.W. Lowlands.—*Dumfries:* Langholm (Ewing). *Kirkcudbright:* New Galloway (M'And.). *Wigtown:* Between Penninghame and House of Hill (Macv.).

N.W. Lowlands.—*Lanark:* Tinto, on wall, alt. 1200 ft., R. (Macv.); Elvanfoot, on banks, R. (Macv.).

E. Lowlands.—*Peebles:* Rachan, on wall, per., R.C. (Macv.); Carton Burn, alt. 1200 ft., R. (Macv.). *Selkirk:* Galashiels, wall, per. (Macv.). *Edinburgh:* Pentland Hills (Grev.); Corstorphine Hill (Grev.); do. (Evans). *Linlithgow:* Craigiehall (M'And.); Gullane (M'And.).

S.E. Highlands.—*Fife and Kinross:* Golland, Kinross (Ewing); Kirkcaldy (Young); Dunearn Hill (Young). *E. Stirling:* Murrayshall, on old wall, ♂ (Evans). *S. Perth:* Aberfoyle (Ewing). *Mid Perth:* Ben Lawers (C. J. Wild. *cf.* Pears. Hep. Brit., p. 345); Killin district, C., Ben Lawers,

alt. 2600 ft., Craig-an-Lochan, Craig Chailleach, alt. 2700 ft. (Macv.); Glen Lochy (H. H. Knight); right bank of R. Garry, Blair Athole (H. H. Knight). *N. Perth:* Dunkeld (M'In.); Glen Beg, Glen Shee, on Junipers (Ewing and Young); Glen Thaitneich (Ewing and Young).

Mid E. Highlands.—*Forfar:* Burn Woods, 1862 (Croall); Auchphersie (Ferg.); nr. Lumley Den (Aimer); Reeky Linn (Aimer). *Kincardine:* Gateside (Sim); Den of Garol (Sim); Scolty (Sim); Inchmarlo (J. W. Fordyce). *S. Aberdeen:* Ben MacDhui, per., 1856 (Croall).

N.E. Highlands.—*Elgin:* Dreggie Burn (Miss Macv.). *E. Inverness:* Laggantigown nr. Aviemore, c. (Macv.); Loch Vaa, stump (Miss Macv.); Kincraig (Miss Macv.); nr. Fort Augustus, on wall (Macv.).

W. Highlands.—*Dumbarton:* Mugdock (Campb.). *Argyll:* Nr. Taynuilt, foot of wall (Macv.). *W. Inverness:* Moidart, r. (Macv.).

Inner Hebrides.—*N. Inner Hebrides:* Ben Cailleach, Broadford, alt. 1600 ft. (Macv.).

Lower N. Highlands.—*W. Ross:* Strathcarron, r. (Macv.). *E. Ross:* Achnasheen, r.c. on banks (Macv.).

Upper N. Highlands.—*E. Sutherland:* The Ord nr. Helmsdale (Lillie). *Caithness:* Dunbeath Strath (Lillie).

Shetland.—Without further locality (Sim).

Lophozia lycopodioides (*Wallr.*) *Cogn.*

Jung. lycopodioides Wallr.

Rare and confined to the higher mountains. Most frequent in Mid Perth; is very rare in the West and North Highlands. Is seldom seen below 2000 ft. alt., but descends in Mid Perth to 1800 ft. alt. in one locality with other alpine species. Usually occurs from 2500–4000 ft. alt.

Is always in small tufts or as scattered stems among other species on moist rock ledges and wet grassy ground. Perianths have not been found with us.

S.E. Highlands.—*Mid Perth:* Ben Lawers, summit, 1893 (Dixon); Killin hills, as Ben Lawers, to 4000 ft. alt., Craig-an-Lochan, r. (Macv.); Ben Heasgarnich (Young); Ben Laoigh, 2400 ft. alt. (Ew. and Macv.).

Mid E. Highlands.—*Forfar:* Glen Dole, 1843 (Gard.); Clova (Kerr); do., 1876 (Ferg.).

W. Highlands.—*W. Inverness:* Roshven, Moidart, 2500 ft. alt. (Macv.).

Lower N. Highlands.—*E. Ross:* Scuir na Lapaich (Cocks).

Upper N. Highlands.—*E. Sutherland:* Ben Griam Mohr, summit (Lillie).

Lophozia Baueriana *Schiffn.*

A subalpine species almost confined to the east, centre, and north of Scotland. It has not been found in the West Lowlands, and only in the eastern part of the East Lowlands, where it has been found in several localities from Berwick to Linlithgow, but nowhere in quantity. It is also uncommon in Fife, but becomes rather frequent north of the Tay to Caithness. It has been met with in greater quantity in Strathspey than elsewhere. It has only been found as yet in one locality in the West Highlands, and not at all in the Hebrides. Has also not been found in Orkney or Shetland. It is most frequent in the lower subalpine region, though ascending in Mid Perth to at least 2600 ft. alt. Perianths are rare; male plants and gemmæ are common; fruit has only been found on one occasion, and was mature in September.

E. Lowlands.—*Berwick:* Longformacus (Miss Macv.). *Edinburgh:* Corstorphine Hill (M'And.); Braid Hills (Evans); nr. Glencorse Reservoir (Evans); Loganlee (A. Murr.). *Linlithgow:* Riccarton Hills (Evans); Craigie Hill (Evans).

S.E. Highlands.—*Fife and Kinross:* Hills above Newburgh (How.); Lomond Hills (Young). *E. Stirling:* King's Park, Stirling (Croall); Goulin Hills, Stirling (Croall); Bridge of Allan (Campb.). *Mid Perth:* Ben Laoigh (Macv.); Ben Lawers, 2600 ft. alt. (Macv.); right bank of R. Garry (H. H. Knight). *N. Perth:* Blair Athole, ♂ (Holmes); Ben Gulabin and Glen Beg (Ewing and Young).

Mid E. Highlands.—*Forfar:* Den of Fullerton, 1852

(Croall); nr. Lumley Den, Sidlaws (Aimer). *Kincardine:* Hill, Gateside, Strachan, *sub nom. J. lycopodioides* (Sim); Bogindreep (Sim); Invery (Sim). *S. Aberdeen:* Maiden Craig, 1836 (Dickie). *N. Aberdeen:* Without further locality (M'And.).

N.E. Highlands.—*Elgin:* Above Sluie, ♂, *sub nom. J. lycopodioides* (Croall). *E. Inverness:* Aviemore district, R.C. (Macv.); Glenferness, ♂ (Miss Macv.); Glen Tromie (Miss Macv.).

W. Highlands.—*W. Inverness:* Spean Bridge (Miss Macv.).

Upper N. Highlands.—*E. Sutherland:* The Ord, ♂ (Lillie). *W. Sutherland:* Strath Halladale (Lillie); Farr (Lillie). *Caithness:* Several places, as Dirlot, Maiden Pap, Morven, Braemore, and Ousdale (Lillie).

Lophozia Floerkii (*Web. et Mohr*) *Schiffn.*

Jung. Floerkii Web. et Mohr

A common and generally distributed species in the subalpine region, with the exception of the West Highlands, Hebrides, and the western part of the North Highlands. It is frequent in the West Lowlands and is very common in the Elvanfoot and Leadhills district, where it is the characteristic species, but becoming uncommon above 1600 ft. alt. It is common in the East Lowlands, being in greater quantity than in the West Lowlands, and is occasionally very common in the Upper Tweed district to 1200 ft. alt. It is common throughout the East Highlands and the eastern side of the North Highlands, the island of Hoy in Orkney, and in Shetland. It is one of the rarest species near the coast of the West Highlands, though becoming less so on the higher hills towards the upper parts of the sea-lochs and on the more inland hills. It is also very rare in the Inner Hebrides, having been found only in Jura, and it has not been found in a typical form in the Outer Hebrides. It ascends to the summit of the hills in Mid Perth, and from 1700 ft. alt. to at least 4000 ft. alt. on Ben Nevis. The species has a distinctly eastern distribution in Scotland, especially to the north of the Forth and Clyde, and though found in some quantity in various parts of the

East Highlands, it is to be found in the greatest abundance in the central subalpine districts of the Lowlands. It grows in green or reddish tufts on banks, rocks, rocky ledges, and sometimes marshes. Perianths and male plants are uncommon; fruit has not been met with. Gemmæ apparently do not occur, or, at least, are very rare.

S.W. Lowlands.—*Dumfries:* Loch Skene, 1830 (Grev. Herb.); Crichope Linn, ♂ (Scott); Langholm, per. (Ewing); Sanquhar district, v. (Macv.). *Kirkcudbright:* New Galloway (M'And.); Screel Hill (A. Murr.); E. of Loch Doon (West).

N.W. Lowlands.—*Ayr:* Beith (Ewing); Largs (Ewing); Mochra Hill (Ewing); Ladyland, several places (Scott). *Renfrew:* Loch Thom (Ewing); nr. Glenlora, per. (Scott); Cloch, ♂ (Macv.); Garvocks Moor (W. E. Nicholson). *Lanark:* Leadhills (Lyon); do., v.c. (Macv.); Wabston (J. Murr.); Crawford and Elvanfoot district, v.c. (Macv.).

E. Lowlands.—*Peebles:* Cowie's Linn (Evans); nr. Carlops (Evans); Logan Water, alt. 800–1200 ft., f. (Macv.); Carton Burn, c., often v.c. (Macv.); Rachan, r.c. (Macv.); Tweedsmuir, f. (Macv.). *Selkirk:* Crosscleugh Burn (Evans). *Roxburgh:* Eildon Hill, above 1000 ft., v.c. (Macv.). *Berwick:* Threeburnfoot (R. Renton); Longformacus (Miss Macv.); nr. Cockburnspath (M'And.); nr. Seenes Law, several places (Evans). *Haddington:* Lammer Law (Evans); nr. Gifford (Evans); Traprain Law (M'And.); Dunbar Common (Evans). *Edinburgh:* Loganlee (A. Murr.); Dalmahoy Hill (A. Murr.); Caerketton Rocks (Evans); Bonally (Evans); Nether Habbie's Howe, per. and ♂ (Evans); Scald Law (Evans); Clubbiedean (M'And.); Braid Hills (Evans); Corstorphine Hill (M'And.). *Linlithgow:* Carriber Glen, per. (A. Murr.).

S.E. Highlands.—*Fife and Kinross:* East of Fife (How.); Lomond Hills (Ewing); do., several places, also per. (Young); Orrock Hill, per. and ♂ (Young); Dunearn Hill (Young); Rumbling Bridge (Evans); Dysart (Young); Upper Largo (M'And.). *E. Stirling:* Earl's Burn Reservoir (K. & S.); hills above Gargunnock, ♂ (K. & S.). *S. Perth:* Menstrie Glen (Evans); Am Binnean (Ewing); Bencleuch, alt. 2363 ft. (Evans). *Mid Perth:* Ben Lawers (Holt *cf.*

Pears. Hep. Brit., p. 349); Ben Heasgarnich (Young); Am Binnean, nr. summit (Evans); Ben Vorlich, summit (Evans); Meal Ghaordie (Young); Killin district, c. from 1800–4000 ft. alt. (Macv.); Ben Dubh Craige, v. (Macv.); Ben Laoigh, R.C. (Macv.); Coire Ardran, alt. 2100 ft. (Macv.); Sma' Glen (Meld.). *N. Perth:* Glen Beg, Glen Shee, on limestone (Ferg.); Glas Meol (Stabl.); Ben Vurock (Ewing); Glen Lochraidh (Ewing and Young); Dunkeld (M'In.).

Mid E. Highlands.—*Forfar:* Sidlaw Hills, 1845 (Gard.); Clova (Gard.); ravine at foot of Glenesk, 1860 (Croall); Glenogil, alt. 1200 ft. (Ferg.); Clova, alt. 2500 ft. (Ferg.); Camlochan (Ewing). *Kincardine:* Gateside (Sim); Feugh Rocks (Sim); Bogindreep, etc. (Sim). *S. Aberdeen:* Deershill Wood, 1843 (Gard.); Loch Phadrick, 1845 (Gard.); Ben MacDhui (Croall); Braemar, per and ♂, 1856 (Croall); Lochnagar (Croall); do., ♂ (Ferg.); Balmoral (Stabl.); Craigendarroch (Ferg.); Meal Odhar (Ewing and Young).

N.E. Highlands.—*Elgin:* Linn of the Shogle, 1848 (Croall); above Sluie (Croall); nr. Grantown (Miss Macv.). *E. Inverness:* Aviemore district, R.C. (Macv.); Kincraig (Miss Macv.); Glen Tromie (Miss Macv.); Mam Soul (Cocks).

W. Highlands.—*Clyde Isles:* Bute (Ewing). *Dumbarton:* Nr. Loch Humphrey, several places (West). *W. Stirling:* Campsie Glen (Dickie); Inch Cailleach (K. & S.). *Argyll:* Puck's Glen (A. Murr.); Ben More, Loch Eck (A. Murr.); Lochan Bhe (Macv.); Ben Arthur, alt. 2300 ft., ♂ and ♀, v. (Macv.); Ben Doureann, v. (Macv.); nr. Kilmun, per. (Scott). *W. Inverness:* Coire Dearg, Glen Nevis, alt. 1800 ft. (Macv.); Choir Arder (Ferg.); Ben Nevis, alt. 3300–4000 ft. (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Jura (Ewing).

Outer Hebrides.—Harris, *forma* (Ewing).

Lower N. Highlands. — *W. Ross:* Strathcarron, R. (Macv.); Ben Liath Mohr, alt. 800 ft. (Macv.); Ben Each, per. (How.). *E. Ross:* Ben Wyvis, 1864 (How.); Achnasheen, c. (Macv.); Sciur na Lapaich (Cocks).

Upper N. Highlands. — *E. Sutherland:* Ben Griam Mohr (Lillie); Strath Ullie (Lillie). *W. Sutherland:* Strath Halladale (Lillie); Ben Clibreck, ♂ (Lillie); Strath Naver (Lillie); Ben Laoghal (Lillie). *Caithness:* Dorrery (Lillie);

Morven (Lillie); Ousdale (Lillie); Reay (Lillie); Scarabin (Lillie); Ulbster (Lillie).

Orkney.—Hoy (West); Ward Hill, Hoy (Lillie); Glen Trowie (Lillie).

Shetland.—Shetland (Sim); Uni Firth (Grieve); Unst and Whalsey, several places (Lillie).

var. Naumanniana *Nees*

S.W. Lowlands.—*Dumfries:* Sanquhar Hill (Macv.).

W. Highlands. — *Dumbarton:* Ben Vorlich (Macv.). *Argyll:* Coire Creachainn, Ben Cruachan, alt. 1500 ft., R. (Macv.).

Upper N. Highlands.—*Caithness:* Newlands of Clyth (Lillie).

Lophozia atlantica (*Kaal.*) *Schiffn.*

Jung. atlantica Kaal.

Known only from two localities in the North Highlands and one in Arran. It forms small patches among rather dry rocks, and the localities are on the low ground of the subalpine region.

W. Highlands.—*Clyde Isles:* Loch Ranza, Arran, 1904 (Macv.).

Upper N. Highlands. — W. *Sutherland:* Farr, 1907 (Lillie). *Caithness:* Dirlot, 1901 (Lillie).

Lophozia gracilis (*Schleich.*) *Steph.*

Jung. gracilis Schleich.
Jung. attenuata Lindenb.

Widely distributed from Dumfries to Caithness, but uncommon. It is uncommon in the West Lowlands, less so in the coastal counties of the East Lowlands, but it has not yet been found either in the Upper Tweed or Upper Clyde districts. It is rather frequent in several parts of the East Highlands, but is uncommon towards its western boundary. It is rare in the West Highlands, and has not been found in the Hebrides. It is also rare in the western part of the North Highlands, though frequent on the eastern side. It has not been found in Orkney or Shetland. This species

has a distinctly eastern distribution in the country, especially in the Highlands. It is less markedly so in the Lowlands. It is confined to the low ground, and grows in close, usually pale green, tufts on banks and walls, also less frequently on rocks and stumps. Perianths are rare, but male plants are frequent; fruit has not been seen. Gemmæ are common.

S.W. Lowlands.—*Dumfries:* Crichope Linn (Scott); Crawick Water, on stumps and rocks (Macv.). *Kirkcudbright:* Benman Hill (Macv.). *Wigtown:* Nr. New Luce (Ewing).

N.W. Lowlands.—*Ayr:* Glen Afton, wall (Macv.). *Renfrew:* Giffnock (Wilkie).

E. Lowlands.—*Berwick:* Cockburnspath (M'And.). *Haddington:* North Berwick Law (M'And.). *Edinburgh:* Roslin Glen, ♂ (A. Murr.); Hawthornden (M'And.); Corstorphine Hill, ♂ (M'And.); Caerketton Rocks (Evans); Nether Habbie's Howe (Evans). *Linlithgow:* Crawhill (Evans).

S.E. Highlands.—*Fife and Kinross:* Tulliallan Wood (Evans). *S. Perth:* Aberfoyle (Evans); Trossachs (Ewing). *Mid Perth:* Finlarig Wood (Ewing); fir wood, Loch Tay (Ewing); Inver Wood (M'In.). *N. Perth:* King's Seat (Ferg.); Ben Gulabin (Ewing and Young); Glen Beg, Glen Shee (Ewing and Young).

Mid E. Highlands.—*Forfar:* Kinnordy (Lyell *cf.* Hook. Brit. Jung., p. 70); Clova, 1842 (Gard.); Deerhill Wood (J. Fulton). *Kincardine:* Several places, as Den of Garol, Invery Wood, Tillylair, Blackhall, and Mount Shade (Sim). *S. Aberdeen:* Braemar, 1857 (Croall); Glen Beg, Braemar (Stabl.).

N.E. Highlands.—*Elgin:* Lochan Dorb (Miss Macv.). *E. Inverness:* Laggantigown nr. Aviemore (Macv.).

W. Highlands.—*Clyde Isles:* Bute (Ewing). *W. Stirling:* Rowardennan (M'And.); Inversnaid (Macv.). *Argyll:* Loch Awe district, R. (Macv.). *W. Inverness:* Moidart, R. (Macv.); Sunart (Macv.).

Lower N. Highlands.—*E. Ross:* Ben Wyvis, ♂, 1864 (How.); Loch Luichart (West); Achnasheen (Macv.).

Upper N. Highlands.—*W. Sutherland:* Strath Naver (Lillie); nr. Ben Rosail (Lillie); Loch Naver (Lillie). *Caith-*

ness: Several places, as Dirlot, Maiden Pap, Ousdale, ♪, Achorn Burn, and Dunbreath (Lillie).

Lophozia quadriloba (*Lindb.*) *Schiffn.*

Jung. quadriloba Lindb.

Has been found only in a few places on the Ben Lawers range of mountains from 1900–3000 ft. alt. It forms small erect tufts among mosses on rock ledges and on banks.

S.W. Highlands.—*Mid Perth:* Craig Chailleach, alt. 2800 ft., 1900 (Macv.); Creag-an-Lochain, alt. 1900–2100 ft., with *Bryum pseudo-triquetrum, Fissidens adiantoides, Ditrichum flexicaule, Hypnum revolvens* (Macv.); Ben Lawers, several places from alt. 2600–3000 ft., with *Bryum pseudo-triquetrum, Fissidens adiantoides, Philonotis fontana* (Macv.); King's Seat, Killin, alt. *ca.* 3000 ft. (H. H. Knight).

Lophozia Kunzeana (*Hüben.*) *Evans*

Jung. Kunzeana Hüben.

This rare alpine species has only been found on a few hills from Ben Nevis to Lochnagar. Occurs in moist or wet ground, usually at the sides of streamlets or in marshes, from 2700–4100 ft. alt.

S.E. Highlands.—*Mid Perth:* Ben Lawers, alt. 2700–3900 ft., 1900 (Macv.); Meal Ghaordie (Ewing); nr. summit of Schiehallion, with *Ptilidium ciliare* and *Dicranum fuscescens* (H. H. Knight).

Mid E. Highlands.—*S. Aberdeen:* Lochnagar, with *Ptilidium ciliare,* 1885 (Ewing).

W. Highlands.—*W. Inverness:* Ben Nevis, alt. 4100 ft. (Macv.).

SPHENOLOBUS (Lindb.) Steph.

Sphenolobus politus (*Nees*) *Steph.*

Jung. polita Nees

This alpine species has been found on some of the hills in Perthshire, in Dumbartonshire and Argyll, and should be expected to occur elsewhere. It has not been found close to the west coast.

It occurs as scattered stems or small erect tufts at the side of streams and in wet places from 1900–3100 ft. alt., sometimes with *Lophozia bantryensis* and *Harpanthus Flotowianus*. The male plant is common; perianths are uncommon, and fruit very rare.

S.E. Highlands.—*Mid Perth:* Ben Lawers, 1885 (Ewing); do., several places from 2700–3100 ft. alt., ♂, 1900 (Macv.); Ben Laoigh, 2000–2400 ft. alt., f. and per. (Macv.); do. (Young); Ben Dubh Craige, 2100 ft. alt. (Macv.); Meal na Saone (Ew. and Young); Ben Heasgarnich (Ewing); Ben Oss (H. H. Knight).

W. Highlands.—*Dumbarton:* Ben Vorlich, 1900 ft. alt., 1901 (Macv.). *Argyll:* Ben Doureann, per. (Ew. and Macv.).

var. medelpadicus *Arnell*

S.E. Highlands.—*Mid Perth:* Carn Creag, Killin, with *Eucalypta commutata, Myurella julacea, Fissidens osmundoides,* and *Selaginella* (H. H. Knight).

Sphenolobus saxicolus (*Schrad.*) *Steph.*

Jung. saxicola Schrad.

I have only seen specimens of this rare species from two districts in the East Highlands. The station at 1200 ft. alt. is an isolated hill on which some other alpine species are also found at a low elevation. Both localities are probably granite. It grows on shady but rather dry rocks.

Mid E. Highlands.—*S. Aberdeen:* Nr. Braemar, with *Gymno. obtusum,* 1894 (Stabl.).

N.E. Highlands.—*E. Inverness:* Carn Dearg, Aviemore, *ca.* 1200 ft. alt., with *Chando. setiformis,* 1898 (Macv.).

Shetland.—Rhonas Hill (Grev. *cf.* Pears. Hep. Brit. p. 356).

Sphenolobus minutus (*Cranz*) *Steph.*

Jung. minuta Cranz

Widely distributed from Dumfries to Shetland, but uncommon. Is rare in the West and East Lowlands, having only been found in a few subalpine localities. Is rare in Fife, though frequent in the eastern parts of the North-East Highlands, but becoming uncommon towards its western boundary. Is generally uncommon in the West Highlands, though found locally in some quantity. It has not yet been found in the Hebrides. It is frequent in the North Highlands, especially in the eastern and northern districts. Is rare in Orkney and Shetland. This species usually occurs with us in the lower subalpine region, and is rare on the hills; it ascends to 2100 ft. alt. in the West Highlands and to 3300 ft. alt. in Mid Perth. Perianths are uncommon and fruit is rare; male plants are frequent. Gemmæ are rather uncommon and generally are limited to the forms of the species with acutely lobed leaves.

Grows in brown patches on peaty banks and among rocks, occasionally on stumps and stems of trees, frequently creeping among mosses and old heather, etc.

In Alpibus Scoticis (Dicks. *cf.* Pl. Crypt., Fasc. ii. p. 14, 1790).

S.W. Lowlands.—*Kirkcudbright:* Blackcraig, New Galloway, per. (M'And.).

E. Lowlands.—*Peebles:* Tweedsmuir, among heather (Macv.). *Edinburgh:* Caerketton Rocks, Pentland Hills (Evans); dyke near Glencorse Reservoir (M'And.).

S.E. Highlands.—*Fife and Kinross:* Lomond Hills (Ewing); do., ♂ (Young). *S. Perth:* Ben Ledi (Dixon); Trossachs (Ewing); Blair Drummond Moss (Evans). *Mid Perth:* Ben Lawers (C. J. Wild *cf.* Pears. Hep. Brit., p. 354); do., 3300 ft. alt., v.r. (Macv. and Young); Craig Chailleach (Ewing); Ben More, per. (E. M. Holmes); Am Binnean, cfr. (Young); Achrioch Wood, on stump and on tree (Macv.). *N. Perth:* Meal Uaine (Ferg.); Glen Thaitneich (Ferg.); do. (Ewing and Young); Ben Gulabin (Ewing and Young); Glas Meol (Stabl.).

Mid E. Highlands.—*Forfar:* Catlaw, Isla, and Castle

Hill (Lyell *cf.* Hook. Brit. Jung., p. 44); Carlowrie, Clova, 1843 (Gard.); The Burn, 1862 (Croall); Auchphersie (Ferg.); Glen Dole (Barker); Sidlaws (Aimer). *Kincardine:* Several places, as Den of Garol, per., Tillylair, Kerloch, and Mount Shade (Sim). *S. Aberdeen:* Craig Choinneach, 1845 (Gard.); Glen Callater (Dickie); Birse (Sim); Finzean (Sim); Feindallachar Burn (Stabl.); Glen Beg, per. and ♂ (Stabl.); Ballochbuie Forest, several places (Stabl.).

N.E. Highlands.—*E. Inverness:* Cairn Gorm (Hook. *cf.* Brit. Jung., p. 44); Glen Tromie, alt. 1000 ft. (Ferg.); Glen Feshie (Barker); Carn Dearg, Aviemore, ♂, alt. 1200 ft. (Macv.).

W. Highlands.—*Clyde Isles:* Rothesay (M'And.). *Dumbarton:* Ben Vorlich, alt. 2100 ft. (Macv.). *W. Stirling:* Rowardennan (M'And.). *Argyll:* Glencoe (Macv.); Oban, cfr. (Ewing); Ben an Dothaidh, several places, *ca.* 1200 ft. alt. (Ewing and Macv.). *W. Inverness:* Ben Nevis (Hook. *cf.* Brit. Jung., p. 44); Coire Dheirg, Glen Nevis, alt. 1900 ft. (Macv.); Choir Arder (Barker); Moidart, f. (Macv.).

Lower N. Highlands.—*W. Ross:* Kyle (Macv.); Strathcarron, f. (Macv.); Loch Maree (Miss Macv.). *E. Ross:* Without nearer locality (Barker); Achnasheen (Macv.).

Upper N. Highlands.—*E. Sutherland:* Strath Ullie (Lillie); nr. The Mound (Lillie). *W. Sutherland:* Strath Halladale (Lillie); Ben Clibreck (Lillie). *Caithness:* Several localities, as Morven, Ousdale, Benacheilt, Watten Moss, per., and Badyrie (Lillie).

Orkney.—Cuilags, Hoy (Lillie).

Shetland.—Roeness Hill (Sim).

var. protractus *Nees*

W. Highlands.—*Argyll:* Ben Arthur (J. Murr.).

Sphenolobus ovatus (*Dicks.*) *Schiffn.*

Jung. ovata Dicks.
Jung. Dicksoni Hook.
Diplophyllum Dicksoni (Hook.) Dum.

Generally distributed over the Highlands, but usually uncommon. Is frequent on the granite of the Kirkcudbright hills (M'Andrew), but it has not been found elsewhere in

the Lowlands. It is rare in the East Highlands, except in the granite districts of Aberdeen and Kincardine, and at the western boundary of this province. Is frequent on the granite and schistose rocks of the West Highlands. Is very rare in the Inner Hebrides, and has not been found in the Outer islands. Is rare in West Ross, and appears to be so throughout the North Highlands. It has not been found in Orkney or Shetland. This species descends to sea-level in the West Highlands, but is uncommon below 800–1000 ft. alt. It ascends to 3000 ft. alt. in Mid Perth, but is very rare at that altitude. It is most common between 1000 ft. and 2000 ft. alt., but one of its favourite localities is in old birch coppices, which are frequently seen near the foot of highland glens, at from 500–1000 ft. alt. In such places it is frequently common on the stems of the trees; also not rarely on isolated birch-trees on the hillside. Although occurring on such trees and more rarely on firs, the most general habitat of the species is on boulders and rocks in partial shade. Perianths are common, and fruit, which is mature from April to August and October, is frequent.

"Found many years since in [the Highland mountains of] Scotland by Mr. Dickson" (*cf.* Hook. Brit. Jung., p. 48).

S.E. Lowlands.—*Kirkcudbright:* Benniguirea (M'And.); nr. Newtown-Stewart (West).

S.E. Highlands.—*E. Stirling:* Glengyle, cfr. (K. & S.). *S. Perth:* Ben Ledi, 1841 (Lyon); Trossachs, ♂ (Ewing). *Mid Perth:* Ben More (Holmes); Ben Lawers, 3000 ft. alt. (Macv.); Creag-an-Lochain, per., 1900 ft. alt. (Macv.); Finlarig Wood, cfr. (Ewing); Ben Dubh Craige, ♂ (Macv.); Achrioch Wood, c. on trees, cfr. f. (Macv.); Coire Ardran, 1900 ft. alt. (Macv.). *N. Perth:* King's Seat Den (Ferg.); Glen Thaitneich (Ewing and Young).

Mid E. Highlands.—*Forfar:* Nr. Falls of Isla (Lyell *cf.* Hook. Fl. Scot., p. 115); Castle Hill, Kinnordy, cfr. (Lyell *cf.* Hook. Brit. Jung., p. 48); Glen Fee, Clova, 1868 (Ferg.). *Kincardine:* Several places, as Tillylair, Garol, Mount Shade, per. c., and f. with *Sphenolobus minutus* (Sim). *S. Aberdeen:* Powlair, with *S. minutus* (Sim); Balmoral, per., with *S. minutus* (Stabl.); Lion's Face, Braemar, per. (Stabl.); Ballochbuie Forest, with *S. minutus* and

Chandonanthus setiformis (Stabl.); Feindallachar Burn, per. (Stabl.).

N.E. Highlands.—*E. Inverness:* Carn Dearg, Aviemore, ♂ (Macv.).

W. Highlands.—*Dumbarton:* Ben Vorlich, per., alt. 1100 ft. (Macv.). *Argyll:* Glencoe, on boulders and trees, alt. 1000 ft. (Macv.); Coire Ghlas, Ben Cruachan, R.C. and cfr., *ca.* 1200 ft. alt. (Macv.); Coire Creachainn, Ben Cruachan (Macv.); nr. Ballachulish (Macv.); Loch Tulla, on fir-tree, R. (Macv.); Ben an Dothaidh, R. (Ewing and Macv.); Ben Arthur, alt. 1100 ft., R. (Macv.). *W. Inverness:* Moidart, F. and cfr. F. (Macv.); Sunart (Macv.); Glen Nevis (Macv.); Ben Nevis (Macv.).

Inner Hebrides.—*N. Inner Hebrides:* Ben Cailleach, Broadford, V.R., alt. 800 ft. (Macv.).

Lower N. Highlands.—*W. Ross:* Ben Liath Mohr, per., V.R., alt. 400 ft. (Macv.). *E. Ross:* Above Achnasheen, among *Gymnomitrium obtusum*, V.R. (Macv.).

Upper N. Highlands.—*W. Sutherland:* Nr. Ben Rosail, ♂ (Lillie). *Caithness:* Morven, ♂ (Lillie).

Sphenolobus Hellerianus (*Nees*) *Steph.*

Jung. Helleriana Nees

Has only been found in two subalpine districts of the East Highlands on decaying logs and on stumps of Scots fir.

N.E. Highlands.—*Mid Perth:* Finlarig Wood, Killin, on decaying logs and stumps, 1901 (Macv.).

Mid E. Highlands.—*S. Aberdeen:* Ballochbuie, 1884 (Michie); Old Mar Forest, Braemar, 1884 (Stabl.); Balmoral, with *Ceph. lunulifolia* (Stabl.); do. with *Nowellia curvifolia* (Stabl.).

Sphenolobus Pearsoni (*Spruce*) *Steph.*

Jung. Pearsoni Spruce

Is confined to granite rocks in Western Scotland from Kirkcudbright to West Inverness and Mull. When near sea-level it has been usually found on boulders in shady ravines. On the hills it occurs on rather wet rocks from

about 800 ft. alt. in Kirkcudbright to 1900 ft. alt. in Argyll. It usually but not always grows directly on the rock, in small yellow compact but brittle tufts or in thin patches. Male plants are common; the female has not been seen.

S.W. Lowlands.— *Kirkcudbright:* Blackcraig, New Galloway, 800 ft. alt., 1887 (M'And.).

W. Highlands.—*Argyll:* Ravine nr. Loch Awe Station, on boulders, alt. *ca.* 200 ft., 1903 (Macv.); Coire Creachainn, Ben Cruachan, on boulders in a few places from 1400–1900 ft. alt. (Macv.); Ben Fhada, Glencoe (West); Balliveolan Burn, L. Crerar, *forma* (Kenn.). *W. Inverness:* Resipol, Sunart, on boulders, alt. *ca.* 200 ft., 1899 (Macv. and Pearson).

Inner Hebrides. — *Mid Inner Hebrides:* Allt na Searmoin, Salen (Kenn.).

Sphenolobus exsectus (*Schmid.*) *Steph.*

Jung. exsectus Schmid.

This is a much rarer species than *S. exsectæformis*, and seems to be confined to the west side of the country. It is not known to have any special western distribution on the Continent, but as it always occurs with us in moist, shaded localities, our wetter western districts afford the most suitable localities for it. It is nearly always found on decaying logs and stumps, very rarely on moss-covered rocks, and only in the low ground. Perianths have not been seen.

W. Highlands. — *Dumbarton:* Tarbert, foot of tree (Macv.). *W. Stirling:* Inversnaid, on stump (Macv.). *Argyll:* Nr. Loch Awe Station, on stump (Macv.).; Glen a Chaolis, Ballachulish, on a log (Macv.). *W. Inverness:* Resipol, Sunart, on a log in ravine, 1901 (Macv.); do., on moss-covered rocks, 1909 (W. E. Nicholson); Coire Dheirg, Glen Nevis, on log (Macv.).

Sphenolobus exsectæformis (*Breidl.*) *Steph.*

Lophozia exsectæformis Breidl. M.S.

Widely distributed from Kirkcudbright to Shetland. It is rare in the Lowlands, especially on the east side, and is confined to the subalpine region. It is uncommon in

general throughout the Highlands, though frequent in various districts, both east and west, and not uncommon in Caithness. It has not yet been found in Orkney, and only in one place in Fair Isle and one in Shetland. This plant does not appear to have any special distribution in the country. It is frequent in such widely separated districts as Moidart, Tyndrum, Strathspey, and Caithness, and is rare or uncommon in some of the intermediate districts. It is a low-ground species in the Highlands, and has only once been found on the hills, in Mid Perth, at 1800 ft. alt.

Grows in small green or brownish patches, or scattered among other species, on decaying logs and stumps and dry banks, both peaty and loamy. It is found in similar places to *S. exsecta*, but the latter does not appear to occur in dry positions. Perianths and male plants are rare; fruit has not been seen.

S.W. Lowlands. — *Kirkcudbright:* New Galloway, in several places, on soil and on wood (M'And.). *Wigtown:* Knowe (Ewing); nr. New Luce (Ewing).

E. Lowlands.—*Peebles:* Carton Burn, at side of drain, alt. 1200 ft. (Macv.). *Roxburgh:* Eildon Hill, alt. 1000 ft. (Macv.). *Berwick:* Hill behind Cockburnspath, on soil (M'And.).

S.E. Highlands. — *Fife and Kinross:* Nr. Kinghorn, per. (M'And.); Tulliallan (Evans); Humbie Wood, Aberdour (M'And.); St Andrews, ♂ (Macv.). *E. Stirling:* Nr. Murrayshall (K. & S.). *S. Perth:* Trossachs, on wood (Ewing). *Mid Perth:* Killin, on wood and on soil (Macv.); Ben Laoigh (Ewing); Achrioch Wood, Tyndrum, F. on stumps (Macv.); Am Binnean, ♂ (Young). *N. Perth:* Ben Gulabin (Ewing and Young).

Mid E. Highlands. — *Forfar:* Nathro (Ferg.); Craig Owl, Sidlaws, on the ground (Aimer). *Kincardine:* Bogindreep, 1873 (Sim); Kerloch, per. (Sim). *S. Aberdeen:* Glen Beg, Braemar (Stabl.). *N. Aberdeen:* Mormond Hill, on soil (Ewing). *E. Inverness:* Aviemore district, in several places, on stumps and on soil (Miss Macv.); above Lochan Dorb, Nairn, on side of ditch (Miss Macv.); peat-moss nr. Carr Bridge (Miss Macv.).

W. Highlands.—*Argyll:* Leiter, Loch Awe, on stump (Macv.); Loch Tulla, on stump (Macv.); Lochan Bhe, on banks (Macv.); Kentallen, on log (Macv.); Sciur Dhearg, Ballachulish (West). *W. Inverness:* Moidart, f., usually on stumps (Macv.); Sunart, on stump (Macv.).

Inner Hebrides.—*N. Inner Hebrides:* Broadford, on bank (Macv.).

Lower N. Highlands. — *W. Ross:* Strathcarron, on stump (Macv.).

Upper N. Highlands.—*E. Sutherland:* Strath Ullie, on soil (Lillie); Helmsdale, on soil (Lillie). *W. Sutherland:* Strath Halladale, on soil (Lillie); Ben Laoghal, on decaying roots (Lillie). *Caithness:* Langwell Deer Forest, Cogle Moss, Strath of Bilster, Dorrery, Dirlot, Watten, nr. Wester Loch, Wick, and Borgue Hill, all on soil (Lillie).

Shetland.—Fair Isle, on soil (Miss Skene); Whalsey, on soil (Lillie).

ACROBOLBUS Nees

Acrobolbus Wilsonii (*Tayl.*) *Nees*

Known only in one ravine, where it has been found in three places, among mosses on wet rocks and on trees. This rare species has only been elsewhere found, in the British Isles, sparingly in the west of Ireland. It is a very difficult plant to detect in the field, as it usually grows as scattered stems, and is of an inconspicuous green colour, resembling the lighter-coloured forms of *Saccogyna viticulosa*, which is one of its accompanying species. It is also accompanied by *Hymenophyllum unilaterale, Plag. spinulosa, Radula aquilegia, Metz. conjugata, Lej. cavifolia, Thuidium tamariscinum, Eurhynchium myosuroides, Hylocomium splendens, H. loreum*, etc. Fruit, not yet exserted, was present in November. Male inflorescence was not seen with certainty.

W. Highlands. — *W. Inverness:* Resipol, on tree in ravine with fr., Nov. 1901 (Macv.); do., among mosses on rocks, 1903 (Macv.).

ANASTREPTA (Lindb.) Schiffn.

Anastrepta orcadensis (*Hook.*) *Schiffn.*

Jung. orcadensis Hook.

Generally distributed over the Highlands in the mountainous districts, with the exception of North Perth, where it is apparently absent, or at least very rare. It is very rare in the Lowlands and in Fife. Is rather common in the East Highlands, especially towards its western boundary, where it is sometimes quite common. It is common, and often very common, on the hills of the West Highlands, and is rather common in the North Highlands. It has not been found in Shetland or the Outer Hebrides, though it doubtless occurs on the hills of the latter district at least; but the want of suitable localities in the exposed islands must cause it to be rare. This species is most common on the hills from about 1500–2500 ft. alt., but it occasionally occurs in quantity in subalpine woods from 800–1200 ft. alt. in the East Highlands, especially towards its western boundary, while it is rather common in several parts of the West Highlands from sea-level on moist shady banks and among long heather. It also sometimes is found among Sphagnum. When on the hills its usual localities are steep grassy banks, rock ledges, and stony ground among *Myrtillus*, etc. It ascends to 3200 ft. alt. in Mid Perth and to 3700 ft. alt. on Ben Nevis. It forms pale-green or reddish-brown erect tufts, and is very frequently in mixture, especially with *Bazz. tricrenata*, which it much resembles when growing. Perianths have not been seen; male plants are uncommon. Gemmæ are common.

N.W. Lowlands.—*Ayr:* Largs, among *Lepidozia Pearsoni* (Ewing).

E. Lowlands.—*Peebles:* Talla Linn, with *Bazzania tricrenata* and *Scapania gracilis*, alt. 1000 ft. (Macv.).

S.E. Highlands.—*Fife and Kinross:* Glen Quoich (Evans). *S. Perth:* Strathyre (Macv.); Inverlochlarig (Evans); Ben Aan, on wood with *Calypogeia Trichomanis* and *Bazzania trilobata* (West); Trossachs (Ewing). *Mid Perth:* Killin Hills, R.C. to 3200 ft. alt. on Ben Lawers (Macv.); Glen

Lochy, ♂ (Young); Ben Vorlich, summit (Evans); Ben Laoigh, v.c. (Macv.); Ben Dubh Craige, R.C. (Macv.); Ben Odhar, U. (Macv.); Am Binnean (Ewing); Coire Ardran, C. from 1900 ft. alt. (Macv.).

MID E. HIGHLANDS.—*Forfar:* Catlaw (Lyell *cf.* Hook. Brit. Jung., p. 71); Clova Mountains, 1824 (Grev.); Glen Dole (Gard.); foot of Glenesk (Croall). *S. Aberdeen:* Dhu Loch (Dickie); Loch Phaderig, 1845 (Gard.); Braemar (Croall); Lochnagar (Stabl.); Glen Beg, Braemar (Stabl.); Ben MacDhui (Stabl.).

N.E. HIGHLANDS.—*Banff:* Head of Glen Avon, 1830 (Grev.); do., 1856 (Croall). *E. Inverness:* Glen Garry (How.); Carn Dearg, Aviemore (Macv.).

W. HIGHLANDS.—*Kintyre:* Tarbert (Ewing). *Dumbarton:* Ben Vorlich, v.c. (Macv.); Arrochar, U. (Macv.). *Argyll:* Glencoe (Macv.); Puck's Glen and Coire Athoich (A. Murr.); head of Loch Awe, U., in ravines (Macv.); Ben Cruachan, C. (Macv.); Loch Tulla, C. on banks in old firwood (Macv.); Ben Doureann, C. (Ewing and Macv.); Meal Odhar, Glen Lochy (Macv.); Kentallen (Macv.); Glen Ure (Kenn.); Ben Arthur, alt. 1700–2300 ft., R.C. (Macv.). *W. Inverness:* Glenfinnan (Carr. *cf.* Pears. Hep. Brit., p. 355); Moidart, C. on low ground, v.c. on the hills (Macv.); Coire Dheirg, etc., Glen Nevis (Macv.); Ben Nevis to 3700 ft. alt. (Macv.); Choir Arder (Barker).

INNER HEBRIDES.—*Mid Inner Hebrides:* Ben More (Kenn.). *N. Inner Hebrides:* Ben Cailleach, Broadford, R.C. (Macv.).

LOWER N. HIGHLANDS.—*W. Ross:* Ben Eay (How.); Loch Maree (Carr.); Strathcarron, R.C. (Macv.); Ben Liath Mohr, at 800 ft., ♂ (Macv.); Strome Ferry (Macv.); Kyle (Macv.). *E. Ross:* Scuir na Lapaich (Cocks).

UPPER N. HIGHLANDS.—*E. Sutherland:* Ben Griam Mohr, ♂ (Lillie). *W. Sutherland:* Canisp, alt. 2000 ft. (Dixon); Ben Clibreck, Ben Laoghal, Betty Hill, and between Durness and Tongue (Lillie). *Caithness:* Morven (Lillie); Scarabin (Lillie).

ORKNEY.—Ward Hill, Hoy, 1808 (Hook. *cf.* Brit. Jung., p. 71); do. (Lillie); Glen Trowie, Hoy, ♂ (Lillie).

PLAGIOCHILA Dum.

Plagiochila tridenticulata *Tayl.*

P. exigua Tayl.

Rare, and confined to the low ground of the west side of the country. It is rather common in several parts of the coast of West Inverness; is very rare in the south-west counties.

Occurs as dark olive-green broad patches on trees and rocks in shady ravines. Generally grows unmixed with other species. Male plants are common; the female has not been seen.

In wet shady places it occurs as *Plag. exigua* Tayl., which is only a state due to its moister position.

N.W. Lowlands.—*Ayr:* Ness Glen, with *Plag. spinulosa, Lej. patens,* and *Metz. hamata,* 1888 (M'And.).

W. Highlands.—*Dumbarton:* Allt Dubh Uisgue, on rocks, R., with *Harpalej. ovata* (Macv.). *Argyll:* Glen Nant, on rocks (Macv.); head of Loch Awe, on rocks in a few ravines, as at Falls of Cruachan (Macv.). *W. Inverness:* Moidart, F. (Macv.); Ardnamurchan, F. (Macv.); Sunart, F. (Macv.).

Inner Hebrides.—*Mid Inner Hebrides:* Tobermory (Ewing); do. (Kenn.).

Lower N. Highlands.—*W. Ross:* Allt Clachan, Loch Carron, R. (Macv.).

Plagiochila punctata *Tayl.*

This Atlantic species is almost confined to the west side of the country. Rare in the West Lowlands and absent from the East Lowlands. In the East Highlands it is only found towards its western side, extending eastward as far as the Trossachs and Killin, where it is rare, but becoming more frequent near the watershed of Argyll. It is common in the West Highlands, and in many places is very common. It is frequent in the Inner Hebrides where there is shelter, and in Harris in the Outer Hebrides; but the general absence of shelter in the islands renders it much less

common than on the mainland. It is rather common in West Ross, probably also near the coast of West Sutherland, but it has not been found in the extreme north of the mainland, nor in Orkney or Shetland. Occurs on limestone as well as on schistose and gneissic rocks, but is uncommon on the first-named formation. It is sometimes in mixture with *P. spinulosa*, less frequently with *P. tridenticulata*. Grows in pale-green compact patches on boulders and half-buried rocks, and frequently on tree stems, especially birch, in very shaded and moist situations. In its eastern limit it seems to be confined to birch-trees. Perianths are rare; male plants very rare. Fruit unknown.

S.W. Lowlands. — *Kirkcudbright:* Glenlaggan Hill (M'And.); Holm Glen (M'And.); Benmyguinea (M'And.); north of Blackcraig, New Galloway (M'And.).

N.W. Lowlands.—*Ayr:* Afton Water, on wall (Macv.); Ladyland (Scott).

S.E. Highlands.—*S. Perth:* Trossachs, on birch-trees (Ewing and West). *Mid Perth:* Achrioch Wood, Tyndrum, on birch-trees, f. (Macv.); Finlarig Wood, Killin, on birch-tree (Ewing).

W. Highlands.—*Kintyre:* Southend (Ewing); Caolisport, per. (Ewing). *Clyde Isles:* Loch Ranza, u. (Macv.); Lamlash (M'And.). *Dumbarton:* Ardlui, r.c. (Macv.); Arrochar, f. (Macv.). *Argyll:* Coire Athoich, Ben More (A. Murr.); Coire Gabhail, Glencoe, alt. 1000 ft. (Macv.); Ballachulish (Macv.); Kentallen (Macv.); Ben Cruachan, r.c. in Coire Ghlais, on boulders (Macv.); Glen Ure (Kenn.); head of Loch Awe, f. (Macv.). *W. Inverness:* Moidart, c. (Macv.); Ardnamurchan, c. (Macv.); Sunart, c. (Macv.); Glenfinnan (Macv.); Coire Dheirg, Glen Nevis (Macv.); Morar, per. (West).

Inner Hebrides.—*S. Inner Hebrides:* Jura (Ewing); Sgor Bhogachain, Islay, alt. 1000 ft. (Gilm.); Ardimersay, Islay (Gilm.). *Mid Inner Hebrides:* Nr. Tobermory (Kenn.); do., f. (Macv.); Allt na Searmoin (Kenn.). *N. Inner Hebrides:* Nr. Loch Coruisk, 1881 (Barker); Corrie and Mill Burn, Broadford, r. (Macv.).

Outer Hebrides.—Tarbert, in many places (West).

Lower N. Highlands.—*W. Ross:* On rocks near Loch

Maree (Carrington); Gairloch (Miss Macv.); Strathcarron, v. (Macv.); Strome Ferry, c. (Macv.); Kyle, r.c. (Macv.).

var. MINUTA (*Bréb.*) *Schiffn.*

W. HIGHLANDS.—*W. Inverness:* Moidart (Macv.).

PLAGIOCHILA SPINULOSA (*Dicks.*) *Dum.*

One of the commonest species of the west coast north of the Clyde, continuing frequent in the centre of Scotland, but becoming rare towards the east and extreme north. This Atlantic species is uncommon in the West Lowlands, and is rare in the East Lowlands, its only stations being a few of the subalpine localities where there is a considerable rainfall. In Fife and the eastern part of the East Highlands it is very rare, and is apparently absent from the greater part of that province to the north and east of the river Tay. In the western part of that province, in South and Mid Perth, it is frequent and occasionally rather common in well-sheltered places. It is common over all the West Highlands and the Inner Hebrides, and is frequent in the Outer Hebrides where there is some shelter. Is common on the west coast of the North Highlands, but is rare in its eastern and northern side. It has been found in some quantity in Hoy in Orkney, but is rare in Shetland.

It occurs most commonly as a low-ground plant in the Highlands, but ascends to 1900 ft. alt. in Mid Perth and to 2300 ft. alt. on Ben Nevis. When this species occurs in districts which have a small rainfall, or when on the hills, it is not seen as the typical plant, but is depauperate, with frequently irregularly shaped leaves. This is very noticeable in specimens from its eastern limit in the country. The antical lobe is also often little decurrent, especially in the hill forms.

It grows in large, erect, green or brownish tufts on moist banks, and frequently covers considerable areas on rocks in moist woods and ravines; also frequent on the lower part of stems of trees. Although it prefers moist situations, it is not limited to them as are *P. punctata* and *P. tridenticulata*.

Perianths are common, but male plants are very rare, and fruit has not been seen.

In Alpibus Scoticis (Dicks. *cf.* Pl. Crypt., Fasc. ii. p. 14, 1790).

S.W. Lowlands.—*Dumfries:* Grey Mare's Tail, 1830 (Grev.); nr. Langholm, 1866 (How.). *Kirkcudbright:* Dalskairth Woods, 1840 (Gray); New Galloway (M'And.). *Wigtown:* W. of Luce, above New Luce (Ewing); Cairnryan (Macv.).

N.W. Lowlands.—*Ayr:* Darvel (Ewing); Largs (Ewing); Kelly Glen (Ewing); Ness Glen (M'And.). *Renfrew:* Lochwinnoch (Ewing).

E. Lowlands.—*Peebles:* Talla Linn, per. R.C. (Macv.). *Edinburgh:* Nether Habbie's Howe, with *Bleph. trichophyllum* (Evans); Moorfoot W., per. (Evans); Logan Burn (M'And.).

S.E. Highlands.—*Fife and Kinross:* St Andrews (How.); Glen Queich (Evans). *E. Stirling:* Dawnie's Loup, Gargunnock Moor, 1879 (Croall); Baston Burn, Touch, per. (Kids. and Stir.); Glengyle (K. & S.). *S. Perth:* Pass of Leny, 1824 (Grev.); Strathyre, R.C. (Macv.); Menstrie Glen (Evans); Trossachs, several places (Ewing and West). *Mid Perth:* Finlarig Burn, R.C. (Macv.); Craig-an-Lochain, alt. 1700–1900 ft. (Macv.); Ben Laoigh, R. (Macv.); Ben Odhar, R. (Macv.); Clifton Burn, F. (Macv.); Achrioch Wood, F. (Macv.); Craig Vinean (M'In.); Inver (M'In.). *N. Perth:* Craighall, 1844 (Gard.); Dunkeld, per. (M'In.).

Mid E. Highlands.—*Forfar:* Reeky Linn (J. Aimer). *Kincardine:* Crathes Wood, nr. Strachan (Sim).

N.E. Highlands.—*E. Inverness:* Invercannich (Cocks); Inchnacardoch, Fort Augustus, C. (Macv.).

W. Highlands.—*Kintyre:* Cantyre (Ewing); Tarbert, per. (Ewing); Clachan (Macrae); Caolisport (Ewing). *Clyde Isles:* Knocan Burn (Campb.); Loch Ranza (Campb.); do., F. (Macv.); nr. Corrie (Miss Macv.); Lamlash, per. (M'And.); Bute (Ewing). *Dumbarton:* Ardlui, C. (Macv.); Arrochar, C. (Macv.); below Loch Humphrey (West); Tarbert (Macv.). *W. Stirling:* Rowardennan, per. (K. & S.); Inversnaid, on rocks, R.C. (Macv.). *Argyll:* Loch Awe side, 1845 (Stark); do., R.C. on boulders (Macv.); Glen Nant, C. (Macv.); Glencoe (Macv.); Ballachulish (Macv.); Kentallen, C. (Macv.); Ben an Dothaidh, alt. *ca.* 1800 ft., R. (Ew. and Macv.); Glen Lochy (Macv.); Glen Ure (Kenn.); Ben

Arthur, alt. 2000 ft. (E. George); Kilmun (Wilkie); Puck's Glen, etc., per. (A. Murr.); Lismore (Macv.). *W. Inverness:* Moidart, v.c. (Macv.); Ardnamurchan, v.c. (Macv.); Sunart, c. (Macv.); Glenfinnan (Macv.); Ben Nevis to 2300 ft. alt. (Macv.); Coire Dheirg (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Jura (Ewing); Ardbeg, Islay (Gilm.); Kildalton Woods (Ewing). *Mid Inner Hebrides:* Tobermory (Ewing); Aros (Kenn.); Dervaig (Macv.). Allt na Searmoin, per. (Kenn.); Ben More (Kenn.); Glenforsa (Kenn.). *N. Inner Hebrides:* Quiraing (Barker); Broadford district, c. (Macv.); Sligachan (Miss Macv.).

Outer Hebrides.—Tarbert (West); Balallan (West).

Lower N. Highlands.—*W. Ross:* Kyle, c., also per. (Macv.); Strome Ferry, c. (Macv.); Strathcarron, v.c., also per. (Macv.).

Upper N. Highlands.—*Caithness:* Langwell, per. (Lillie).

Orkney.—Ward Hill, Hoy, several places (Lillie); Segal Burn, Hoy, v.c. (Lillie).

Shetland.—Yell (Sim).

var. inermis *Carr.*

S.E. Highlands.—*E. Stirling:* Boquhan Glen (Kids. and Stir.).

W. Highlands.—*Kintyre:* Kintyre, without nearer locality (Ewing). *Dumbarton:* Allt Dubh Uisgue (Macv.); Arrochar (Macv.).

Inner Hebrides.—*Mid Inner Hebrides:* Tobermory, wall and rock (Macv.).

Outer Hebrides.—Harris (Ewing).

Orkney.—Ward Hill, Hoy (Lillie).

Plagiochila asplenioides (*L.*) *Dum.*

One of the most common and generally distributed species. While it is common all over the Highlands from sea-level to at least 4000 ft. alt., it is uncommon in some parts of the Lowlands, even in subalpine districts, as in the Upper Clyde and Upper Tweed districts, where it cannot be classed among the species most frequently met with. It

is, however, present in every district which has been searched. I have seen some hundreds of specimens from all over the country and from every county, so that its local distribution is not here given. It grows in many kinds of situations, both moist and dry, and on different formations. Perianths and male plants are both rather common, but fruit is somewhat uncommon, and is usually seen when on moist shady rocks; it is mature from April to June and in September.

The var. *minor* in its characteristic form, which we know as *P. Dillenii* Tayl., is frequent on boulders and rocks in moist subalpine ravines. Var. *humilis* is generally found on soil.

The var. *major* Nees is generally distributed from Dumfries to Caithness. It is frequent in the Lowlands and in the East Highlands, becoming more common towards its western boundary, and is common in the West Highlands. The want of sheltered ground makes it rare in the Hebrides. It is common in West Ross. It is confined to the low ground and to moist shady places, and is especially luxuriant in ravines and steep banks among coppices. It occasionally takes the place of the typical plant in some glens, but the variety usually grows among grass, etc., on banks, while the type is more often seen on rocks. Male plants are frequent, perianths less so, and fruit has not been seen.

var. MINOR *Nees*

Plag. Dillenii Tayl.

S.W. LOWLANDS.—*Dumfries:* Sanquhar district, c. (Macv.); Crichope Linn, c. (Macv.). *Kirkcudbright:* Penkill Burn, per. (Macv.); New Galloway, per. (M'And.). *Wigtown:* Dunsky Glen (M'And.); Cairnryan (Macv.).

E. LOWLANDS.—*Peebles:* Cowie's Linn (Evans). *Edinburgh:* Torduff (Evans); Bonally Glen (Evans).

S.E. HIGHLANDS.—*S. Perth:* Wharry Glen (Evans); Menstrie Glen (Evans). *Mid Perth:* Achrioch Wood, in stream (Macv.); Clifton Burn, c. (Macv.); Finlarig Burn etc., Killin (Macv.)

MID E. HIGHLANDS.—*Forfar:* Fullerton Den (Ferg.).

N.E. HIGHLANDS.—*Elgin:* Dreggie Burn (Miss Macv.). *E. Inverness:* Druie river, Aviemore (Macv.).

W. HIGHLANDS.—*Dumbarton:* Ardlui (Macv.). *Argyll:* Loch Awe (Macv.). *W. Inverness:* Moidart, F. (Macv.); Ardnamurchan, F. (Macv.); Sunart, F. (Macv.).

INNER HEBRIDES.—*Mid Inner Hebrides:* Nr. Tobermory (Kenn.).

LOWER N. HIGHLANDS.—*W. Ross:* Strathcarron (Macv.).

var. HUMILIS *Nees*

S.W. LOWLANDS.—*Kirkcudbright:* Creetown (Macv.).

N.W. LOWLANDS.—*Renfrew:* Cloch (Macv.).

E. LOWLANDS.—*Haddington:* Dunglass Woods (M'And.). *Edinburgh:* Craiglockhart Woods (M'And.).

S.E. HIGHLANDS.—*Fife and Kinross:* Nr. Wormit (Aimer); Dysart (Young).

MID E. HIGHLANDS.—*Forfar:* Sidlaws (Aimer).

W. HIGHLANDS.—*W. Inverness:* Moidart (Macv.).

SHETLAND.—Unst (Sim).

var. MAJOR *Nees*

S.W. LOWLANDS.—*Dumfries:* Sanquhar district, C. (Macv.); Crichope Linn, F. (Macv.). *Kirkcudbright:* Dalskairth, 1840 (Cruicks.). *Wigtown:* Lochnaw (Col. Stirling); Loch Ryan (Ewing); Dunsky Glen (Macv.).

N.W. LOWLANDS.—*Ayr:* Glen Afton, U. (Macv.). *Renfrew:* Glen, Misty Law (Scott). *Lanark:* Falls of Clyde (Ewing); Cartland Crags (Macv.).

E. LOWLANDS.—*Selkirk:* Hartwood Burn (Evans); Glenkinnon Burn, F. (Macv.). *Roxburgh:* Nr. Kelso (Scott); Rhymer's Glen, Melrose, C. (Macv.). *Haddington:* Ormiston Hall Woods (Evans). *Edinburgh:* Lasswade, 1825 (Grev.); Glencorse Woods (Evans). *Linlithgow:* Abercorn Glen (Evans).

S.E. HIGHLANDS.—*Fife and Kinross:* Maspie Den, Falkland, cfr. (How.); Kirkcaldy (Young). *E. Stirling:* Easter Glen, Gargunnock, per. (K. & S.). *S. Perth:* Pass of Leny, 1824 (Grev.); Wharry Glen, nr. Bridge of Allan (Evans). *Mid Perth:* Finlarig Burn, C. (Macv.); Clifton Burn, Tyndrum, R.C. (Macv.); Methven Wood (Meld.). *N. Perth:* Nr. Dunkeld (M'In.).

Mid E. Highlands.—*Forfar:* Sidlaw, 1840 (W. Jackson); Reeky Linn, 1846 (Gard.); do., 1906 (Aimer); foot of Glenesk (Croall); Rescobie (Gard.). *Kincardine:* Drumtochty, cfr. (Sim).

N.E. Highlands.—*Elgin:* Dreggie Burn, nr. Grantown (Miss Macv.). *E. Inverness:* Nr. Aviemore (Macv.); Invercannich (Cocks).

W. Highlands.—*Kintyre:* Ronachan (Macrae). *Clyde Isles:* Loch Ranza (Macv.). *Dumbarton:* Ardlui (Macv.); Arrochar, R.C. (Macv.). *Argyll:* Inveraray (W. Campbell); Glen Nant (Macv.); Kentallen (Macv.). *W. Inverness:* Moidart, F. (Macv.); Ardnamurchan, F. (Macv.); Sunart, F. (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Kildalton, Islay (Gilm.). *Mid Inner Hebrides:* Tobermory, V.C. (Macv.); Dervaig (Macv.). *N. Inner Hebrides:* Broadford, R. (Macv.).

Outer Hebrides.—Harris (Ewing).

Lower N. Highlands.—*W. Ross:* Strome Ferry, C. (Macv.); Strathcarron, R. (Macv.). *E. Ross:* Fairy Glen, Rosemarkie (Miss Macv.).

Upper N. Highlands.—*Caithness:* Dunbeath Strath (Lillie).

PEDINOPHYLLUM Lindb.

Pedinophyllum interruptum (*Nees*) *Schiffn.*

Plagiochila interrupta Dum.

Has only been found on the limestone island of Lismore.

W. Highlands.—*Argyll:* Lismore, 1898 (Macv.).

LEPTOCYPHUS Mitt.

Leptocyphus Taylori (*Hook.*) *Mitt.*

Mylia Taylori S. F. Gray

Generally distributed over the subalpine region from Dumfries to Shetland. It is uncommon in both West and East Lowlands, though frequent in a few localities. It is present in the Southern Uplands only in those places

where there is damp peaty soil in quantity, and has rarely been found on the low-lying peat-mosses of that district. It is common over most of the Highlands where there is peat, but is especially common in the West Highlands and Hebrides and the western side of the North Highlands. In the drier district of the East Highlands, even where there are large tracts of peat, it is frequently uncommon. In the West Highlands it is in most quantity on the low ground near sea-level and lower slopes of the hills. In this province it is uncommon above 2000 ft. alt., though ascending to 3700 ft. alt. on Ben Nevis. In the East Highlands it is frequent on some hills to 2500 ft. alt., but rarely ascends above 3000 ft. alt.

Forms large, erect, yellow-green to reddish-purple patches on peat-mosses, wet peaty banks, and frequently scattered among Sphagnum. Occasionally it is found on the stems of birch-trees in damp hollows, and on stumps. On the west coast it frequently forms large dirty green cushions on dripping rocks. Not rarely this species is prostrate and creeping when on peaty banks.

Fruit is uncommon, but is usually in abundance when present; it is mature in July and August. Gemmæ are frequent.

S.W. Lowlands. — *Kirkcudbright:* New Galloway (M'And.). *Wigtown:* New Luce Moor (M'And.); nr. New Luce (Ewing).

N.W. Lowlands. — *Renfrew:* Lochwinnoch (Ewing); Misty Law (Scott); nr. Barochan (W. E. Nicholson). *Lanark:* Cathkin Hills (D. Don *cf.* Hook. Fl. Scot., p. 115); Dungarvel (J. Murr.); Elvanfoot peat-mosses, v.r. (Macv.); Lousie Wood Law, f. from 1700–1900 ft. alt. (Macv.).

E. Lowlands.—*Peebles:* Moor nr. Leadburn (Evans); Cowie's Linn (M'And.); Talla Linn, c. (Macv.). *Haddington:* Lammer Law (Evans). *Edinburgh:* Moss on Harperrig Reservoir (Evans). *Linlithgow:* Crawhill, damp shady rocks (Evans).

S.E. Highlands.—*Fife and Kinross:* Lomond Hills (Ewing); nr. Loch Glow (Evans). *S. Perth:* Ochil Hills (D. Don *cf.* Hook. Fl. Scot., p. 115); Menstrie Glen (Croall); Strathyre (Macv.); Ben Ledi (Meld.); Trossachs,

cfr. (Dixon); Blair Drummond (Evans). *Mid Perth:* Meal Ghaordie (Young); Craig-an-Lochain (Macv.); Ben Lawers, alt. 2700–2900 ft. (Macv.); Ben Cruban, Killin (J. Hunter); Ben Vorlich, summit (Evans); Stuc-a-Croin (Meld.); Craig Vinean (M'In.); Ben Laoigh, c. (Macv.); Ben Dubh Craige, c. from 2600–3000 ft. (Macv.); Achrioch Wood, c. on stumps, f. on trees and banks (Macv.); Ben Heasgarnich (Young); Am Binnean (Young); Coire Ardran, c. (Macv.). *N. Perth:* Glen Thalachan, per. (Ferg.).

Mid E. Highlands.—*Forfar:* Clova Mountains (G. Don *cf.* Hook. Brit. Jung., p. 57); do., 1824 (Grev.); Glen Dole, 1843 (Gard.); foot of Glenesk (Croall); Werron, 1841 (Ed. Herb.); Caness (Ewing). *Kincardine:* Dalfro, Kerloch, and Commonty (Sim). *S. Aberdeen:* Ben-a-Bourd (Croall *cf.* Carr. Brit. Hep., p. 68); Lochnagar (Dickie); do. (Sim); Braemar (Dickie); do., 1856 (Croall); Ben Beag, 1843 (Gard.); Glen Beg, Braemar, ♂ (Stabl.); Balmoral, ♂ (Stabl.).

N.E. Highlands.—*Banff:* Head of Glen Avon, 1856 (Croall): *E. Inverness:* Cairngorm (Hook. *cf.* Brit. Jung., p. 57); nr. Aviemore (Macv.).

W. Highlands.—*Kintyre:* Without further locality, ♂ (Ewing); Tarbert (Ewing); nr. Lochgilphead (Ewing). *Clyde Isles:* Loch Ranza (Campb.); do., r.c., on banks (Macv.). *Dumbarton:* Ben Vorlich, v.c., 1800–2300 ft. alt. (Macv.); Allt Dubh Uisgue (Macv.); ravine nr. Arrochar Station, c. (Macv.). *W. Stirling:* Inversnaid (K. & S.); do., per. (Macv.); Glengyle (K. & S.). *Argyll:* Coire Athoich, Ben More (A. Murr.); head of Loch Awe, f. (Macv.); Ben Cruachan, f., to 1900 ft. alt. (Macv.); Glencoe, r.c. (Macv.); Ben Udlaidh, 2100–2400 ft. alt. (Macv.); Loch Tulla, c. (Macv.); Ben Doureann, c., ascending to 3100 ft. alt. (Ewing and Macv.); Glen Lochy (Macv.); Kentallen (Macv.); Ben Arthur, 1600–2500 ft. alt., r.c. (Macv.). *W. Inverness:* Ben Nevis, 1821 (Grev.); do., alt. 3700 ft. (Macv.); Coire Dheirg, Glen Nevis, alt. 500–1800 ft. (Macv.); Choir Arder (Ferg.); Moidart, v.c. (Macv.); Ardnamurchan, v.c. (Macv.); Sunart, v.c. (Macv.); Morar (West).

Inner Hebrides.—*S. Inner Hebrides:* Sgor Bhogachain, Islay, alt. 1000 ft. (Gilm.). *Mid Inner Hebrides:* Loch

Frisa (Macv.); Allt na Searmoin (Kenn.). *N. Inner Hebrides:* Broadford district, R.C. (Macv.).

OUTER HEBRIDES.—Barra (Ewing); Clisham (West); Tarbert, per. (West); Balallan (West).

LOWER N. HIGHLANDS.—*W. Ross:* Ben Slioch, 1867 (How. and Jenner); Ben Eay (How.); Strathcarron, v.c. (Macv.); Strome Ferry (Macv.); Kyle, v.c. (Macv.); Loch Maree (Miss Macv.). *E. Ross:* Achnasheen, c. (Macv.); Scuir na Lapaich (Cocks).

UPPER N. HIGHLANDS.—Sutherland, without nearer locality, 1834 (Grev.). *E. Sutherland:* Ben Griam Mohr (Lillie). *W. Sutherland:* Ben Clibreck (Lillie). *Caithness:* Several localities, as North Watten Moss, Dunnet Head, Morven, and Scorriclate (Lillie).

ORKNEY.—Kirkwall (West); Stromness (West); Hoy (Lillie); Quoyawa (Lillie).

SHETLAND.—Unst (Sim); Whalsey (Lillie).

LEPTOCYPHUS ANOMALUS (*Hook.*) *Lindb.*

Mylia anomala S. F. Gray

Generally distributed from Dumfries to Shetland where wet peaty ground is present. In contradistinction to *L. Taylori*, the present species is common on the low-lying peat-mosses of the Lowlands. As a large part of the Lowlands has been drained for agriculture, it is absent from large tracts where no doubt it was formerly present, as well as being absent from other districts owing to an absence of peat. This also applies to large districts of the East Highlands: but after taking this into consideration, it is relatively more common on the east side of the country than on the west, this being the reverse of the case in *L. Taylori*. In the West Highlands it is common in some districts, but it is more generally only to be considered as frequent, and it is often uncommon. This also applies in a greater degree to the Inner Hebrides, and it has not been recorded from the Outer Hebrides, though it doubtless occurs there. It is frequent in the North Highlands. In Orkney and Shetland there is little peat remaining, and the plant is uncommon. It is more of a low-ground species than *L. Taylori*, and is rare above 1500 ft. alt. in

the Highlands. It ascends to 1900 ft. alt. in the Lowlands, and to the same height in the Highlands, though in one case it has been found to 2200 ft. alt. The species forms small, low-lying, reddish-brown patches, or more commonly creeping among Sphagnum, on peat-mosses and wet moors. It occasionally is found on stumps, and as dark olive-green erect tufts in very wet ground. Perianths have not been seen; gemmæ are always present.

S.W. Lowlands.—*Dumfries:* Solway Moss (Scott); Moffat (Miss Macv.); Sanquhar Moor, c. (Macv.). *Kirkcudbright:* High Park, New Galloway (M'And.); Dalskimmer Hill (M'And.); Glen Trool (Macv.). *Wigtown:* New Luce Moor (M'And.); nr. New Luce (Ewing).

N.W. Lowlands.—*Ayr:* Barskimming Moor (Scott). *Renfrew:* Nr. Loch Thom (West). *Lanark:* Cobbinshaw (Ewing); Elvanfoot peat-mosses, v.c. (Macv.); Lousie Wood Law, f. 1700–1900 ft. alt. (Macv.); Kirk Burn, Tinto (Macv.).

E. Lowlands.—*Peebles:* Nr. Cowie's Linn (Evans); nr. Leadburn (Evans); Talla Water, alt. 1400 ft. (Macv.); Tweedsmuir (Macv.). *Selkirk:* Nr. Tushielaw (Evans). *Berwick:* Nr. Seenes Law (Evans). *Haddington:* Lammer Law (Evans); Dunbar Common (Evans). *Edinburgh:* Balerno Moss, f. (Macv.); Bonally Hill (Evans); Auchincorth Moss (Evans); Baads (Ewing); Cobbinshaw Moss (Evans). *Linlithgow:* Fauldhouse Moss in several places (Evans).

S.E. Highlands.—*Fife and Kinross:* Lomond Hills (Young); Moss Morran (Young). *E. Stirling:* Ridgehead Moss (Evans). *S. Perth:* Nr. Aberfoyle (Evans); Trossachs (Ewing); Blair Drummond Moss (Evans). *Mid Perth:* Nr. Methven (Ferg.); Lochan-na-Lairige, alt. 1800 ft. (Macv.); Meillor Bog, alt. 1800 ft. (Macv.); Achrioch Wood, f. on stumps (Macv.); Meal Ghaordie (Ewing). *N. Perth:* Drumlochy (Ferg.); Ben Gulabin (Ewing and Young).

Mid E. Highlands.—*Forfar:* Kinnordy (Lyell *cf.* Hook. Brit. Jung., p. 34); foot of Glenesk, 1862 (Croall). *Kincardine:* Tillylair (Sim); Kerloch (Sim). *S. Aberdeen:* Powlair (Sim); Lochnagar (Stabl.); Glen Beg, Braemar (Stabl.). *N. Aberdeen:* Mormond Hill (Ewing).

N.E. Highlands.—*E. Inverness:* Chisholm's Pass, 1847 (Grev. Herb.); nr. Carr Bridge (Miss Macv.); Boat of Garten (Miss Macv.); moor above Insh (Miss Macv.).

W. Highlands.—*Clyde Isles:* Nr. Loch Ranza, on peat-moss, c. (Macv.). *Dumbarton:* Ardlui (Macv.). *Argyll:* Ben Udlaidh, alt. 1900 ft. (Macv.); Ben an Dothaidh (Ewing and Macv.). *W. Inverness:* Choir Arder, 2210 ft. alt. (Ferg.); Moidart, c. (Macv.); Ardnamurchan (Macv.); Sunart (Macv.).

Inner Hebrides.—*Mid Inner Hebrides:* Loch Misnish (Macv.); L. Frisa (Macv.). *N. Inner Hebrides:* Moss nr. Broadford, r. (Macv.).

Lower N. Highlands.—Ross-shire, without nearer locality, 1847 (Grev. Herb.). *W. Ross:* Kyle (Macv.); Strathcarron Moss, u. (Macv.). *E. Ross:* Loch Rosque (West).

Upper N. Highlands.—*E. Sutherland:* Ben Griam Mohr (Lillie). *E. Sutherland:* Between Durness and Tongue (Lillie). *Caithness:* Several localities, as North Watten Moss, Camster, Cogle Moss, and Badyrie (Lillie).

Orkney.—Kirkwall (West).

Shetland.—Unst (Sim); do. (Lillie); Scalloway (West).

Leptocyphus cuneifolius (*Hook.*) *Mitt.*

Clasmatocolea cuneifolia (Hook.) Spruce

Very rare, though frequent in Moidart, West Inverness. Is confined to the west side of the country, though passing into the eastern watershed in one locality. It rarely ascends above 300 ft. alt., but is found to 1000 ft. alt. Forms reddish-brown patches on birch-trees, rarely on rocks, and frequently among *Frullania Tamarisci* or *F. germana*. In one district it has been found on a mountain ash. It occurs only in very shaded moist localities. No inflorescence has been seen.

S.E. Highlands.—*Mid Perth*: Achrioch Wood, Tyndrum, on a few birch-trees on *Frull. Tamarisci*, with *Ceph. Starkii* and *Sphen. exsectæformis*, 1903 (Macv.).

W. Highlands.—*Dumbarton:* Ben Vorlich ravine, on birch-tree, v.r., 1901 (Macv.). *Argyll:* Coire Gabhail,

Glencoe, alt. 1000 ft., on boulders on *Frull. Tamarisci*, 1899 (Macv.); Sciur Dearg, Ballachulish, with *Plag. punctata*, *Sphen. acutus*, and *Microlejeunea ulicina* (West); Ben Fhada, Glencoe (West); Balliveolan Burn, L. Creran (Kenn.). *W. Inverness:* Moidart, several places, usually on birch-trees, rarely on rocks, 1898 (Macv.); Ardnamurchan, on birch-trees in some quantity, Salen Burn (Macv.).

LOPHOCOLEA Dum.

Lophocolea bidentata (*L.*) *Dum.*

Generally distributed from Dumfries to Shetland. This species and *L. cuspidata* are found in much greater quantity in the Lowlands than in the Highlands; they are the only generally distributed species of which this can be said, with the possible exception of *Conocephalum conicum*. The present plant usually occurs in a sterile state, and frequently only as scattered stems among mosses. As it cannot usually be distinguished with certainty from *L. cuspidata* in the absence of inflorescence, its distribution is less accurately known than in the latter species. It is, however, common on walls, etc., in the region of cultivation in the Lowlands, and is frequent in the lower subalpine region. It is common in the low-lying parts of the East Highlands, and is rather common, but much less so, in the West Highlands. It appears to be frequent in the North Highlands, and less so in Orkney and Shetland. This species is uncommon on the Southern Uplands, where it ascends to 2100 ft. alt. It is rare on the hills in the Highlands, and has not been found above 2000 ft. alt.

It frequently forms large tufts on walls in the Lowlands and part of the East Highlands, but usually occurs only as thin patches or scattered stems in the West and North Highlands. Perianths are rare, and fruit, which matures in April and May, is very rare.

S.W. Lowlands.—*Dumfries:* Moffat (M'And.); Euchan W. (Macv.); Wanlockhead (Macv.). *Kirkcudbright:* New Galloway (M'And.); White Loch, Colvend (Ham.); Cree-

town (Macv.). *Wigtown:* Loch Ryan (Ewing); Aldouran Glen, c. (Macv.).

N.W. Lowlands.—*Ayr:* Troon (J. Murr.). *Renfrew:* Loch Thom (Ewing); Glen, Misty Law (Scott); Cloch, per. (Macv.). *Lanark:* Falls of Clyde (J. Murr.); Cartland Crags, v.c. (Macv.); Tinto, to alt. 1900 ft., u. (Macv.); Elvanfoot district, f. but not c. (Macv.); Green Lowther, ascending to 2100 ft. alt., u. (Macv.).

E. Lowlands.—*Peebles:* Cowie's Linn (A. Murr.); Macbiehill (Evans); Lamancha (Evans); Carton Burn, alt. 1200 ft. (Macv.); Rachan (Macv.). *Selkirk:* Philiphaugh (Evans). *Roxburgh:* Fernieherst (Miss Macv.); Kelso (Scott). *Berwick:* Pease Dean, v.c. (Macv.); Longformacus (Miss Macv.). *Haddington:* Dunglass Woods (Evans); Lennoxlove (Evans); Gullane Links (M'And.). *Edinburgh:* Roslin Glen (A. Murr.); Balerno Moss (Macv.); Whitehill Glen (Evans); Glencorse Woods (Evans); Allermuir Burn (Evans); Braid Hills (Evans). *Linlithgow:* Riccarton Hills, several places (Evans); Bathgate (Evans); Carriber Glen (M'And.).

S.E. Highlands.—*Fife and Kinross:* Kenly Den (How.); Kirkcaldy (Young); Kinghorn (Evans). *E. Stirling:* Wester Glen, Gargunnock (K. & S.). *S. Perth:* Menstrie Glen (K. & S.); Strathyre (Macv.). *Mid Perth:* Killin district, c. (Macv.). *N. Perth:* Dunkeld (M'In.).

Mid E. Highlands.—*Forfar:* Den of Fullerton, 1855 (Croall); foot of Glenesk (Croall); Nathro (Ferg.); Fern (Ferg.); Reeky Linn (Aimer). *Kincardine:* Den Fenella (Ferg.); Strachan (Sim); Feugh Rocks (Sim); Inchmarlo (Fordyce); Stonehaven (M'And.). *S. Aberdeen:* Craigendarroch (Ferg.); Lion's Face, Braemar (Stabl.); nr. Aberdeen (Barker). *N. Aberdeen:* Mormond Hill (Ewing).

N.E. Highlands.—*Banff:* Head of Glen Avon, 1855 (Croall); Tomintoul (Miss Macv.). *Elgin:* Nr. Forres, 1848 (Croall); Dreggie Burn (Miss Macv.). *E. Inverness:* Loch Vaa, per. (Miss Macv.).

W. Highlands.—*Kintyre:* Campbeltown (Ewing); Clachan (Macrae). *Clyde Isles:* Bute (Ewing); Loch Ranza, R. (Macv.). *Dumbarton:* Ardlui (Macv.); Arrochar (Macv.). *Argyll:* Puck's Glen (A. Murr.); Kentallen (Macv.).

W. Inverness: Moidart, c. (Macv.); Ardnamurchan, c. (Macv.); Sunart, c. (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Ardtalla, Islay, per. (Gilm.). *Mid Inner Hebrides:* Tobermory, r.c. (Macv.).

Outer Hebrides.—Stornoway, cfr. (Gibs.).

Lower N. Highlands.—*W. Ross:* Strome Ferry (Macv.); Strathcarron (Macv.). *E. Ross:* Achnasheen (Macv.); Fortrose (Miss Macv.).

Upper N. Highlands.—*E. Sutherland:* Nr. Loth (Lillie). *W. Sutherland:* Ben Clibreck (Lillie). *Caithness:* Watten (Lillie); Dunnet Links (Lillie); Ousdale (Lillie).

Orkney.—Nr. Finstown, on wood (West); Stennis (Lillie).

Shetland.—Unst (Sim); Lerwick (West); Fair Isle (Miss Skene).

Lophocolea cuspidata *Limpr.*

A common and generally distributed species from Dumfries to the North Highlands, and extending to Shetland. As with *L. bidentata*, it is found in greater quantity in the Lowlands than in the Highlands. It is common in the cultivated region of the West and East Lowlands and frequent in the subalpine region, but does not ascend the hills as does *L. bidentata*. It is also common in the East and West Highlands and the Inner Hebrides, also in West Ross, but it appears to be less frequent in the North Highlands, and uncommon in the Outer Hebrides, Orkney and Shetland. In these exposed islands the want of shelter gives few suitable habitats for this species. It is a much more common species than *L. bidentata* in Scotland, especially in the West Highlands. It being, however, very often with inflorescence, and thus in a condition for accurate identification, it is probably more often noted than is the other species, in proportion to their relative frequency. It is most typical as compact patches on decaying logs, where it fruits freely from March to July; it also occurs on banks and old walls and about tree roots. In these last localities it is frequently sterile.

S.W. Lowlands.—*Dumfries:* Gallow Hill, Moffat (M'And.); Dumcrief, cfr. (Miss Macv.); Crichope Linn, f.

(Macv.). *Kirkcudbright:* Several places, New Galloway, cfr. (M'And.). *Wigtown:* Lochnaw (Stirling); Knowe, cfr. (Ewing); Castle Kennedy, stumps, cfr. (Macv.); Glenluce, cfr., c. (Macv.); Stranraer, cfr. (Macv.).

N.W. Lowlands.—*Ayr:* Carfine (Kids.); Darvel (Ewing); Beith (Ewing); Barskimming (Scott); Ladyland, cfr. (Miss Macv.). *Renfrew:* Loch Thom, cfr. (Ewing); Cloch (West); Glen, Misty Law (Scott). *Lanark:* River Calder, Uddingston (Ewing); Cadder, cfr. (J. Murr.); Blantyre Priory, cfr. (Ewing); Cartland Crags, f. (Macv.); Kirk Burn, Tinto (Macv.); Crawford, cfr. (Macv.); Elvanfoot district, f. about tree roots (Macv.).

E. Lowlands.—*Peebles:* Cowie's Linn, per. (Evans); Rachan, cfr. c. (Macv.). *Selkirk:* Bowhill (Evans); Hartwood Burn, per. (Evans); Bowden (Evans); Lindean, cfr., c. (Macv.); Caddon W., c. (Macv.); Glenkinnon Burn, c. (Macv.). *Roxburgh:* Kelso (Scott); Melrose district, per., v.c. (Macv.); Hawick, per. (Macv.). *Berwick:* Longformacus (Miss Macv.); Cockburnspath, c. (M'And.). *Haddington:* Dunglass, per. (Evans); Yester Woods, per. (Evans). *Edinburgh:* Bavelaw Castle, cfr. (Evans); Pentlands (A. Murr.); Glencorse Woods (Evans); Hillend Hill, cfr. (Evans); Braids, cfr. (Evans); Braid Hermitage, cfr. (Evans); Bilston Glen (Evans); Craiglockhart Wood, per. (Evans); Hawthornden, cfr. (M'And.); Arniston Glen, per. (M'And.). *Linlithgow:* Carriber Glen (A. Murr.); Dalmeny, per. (M'And.); Bathgate, per. (Evans).

S.E. Highlands.—*Fife and Kinross:* Kinghorn, per. (M'And.); Dunearn Hill, cfr. (Young); nr. Aberdour (Evans); Otterston Loch (Miss Macv.); Falkland Woods (Evans); Humbie Wood (M'And.). *E. Stirling:* Wester Glen, Gargunnock, cfr. (K. & S.). *S. Perth:* Trossachs, cfr. (Ewing and West). *Mid Perth:* Killin (Macv.); Ben Laoigh (Macv.); Inver, cfr. (M'In.); Lamberkin, per. (Meld.); Auchlyne, cfr. (Ewing). *N. Perth:* Stormontfield, per. (Meld.).

Mid E. Highlands.—*Forfar:* Den of Fullerton, cfr., 1855 (Croall); Fern (Ferg.); Clova, cfr. (G. West). *Kincardine:* Blackhall (Sim); Scolty (Sim); Stonehaven (M'And.). *S. Aberdeen:* Nr. Aberdeen (Barker); Lion's Face, Braemar (Stabl.); Abergeldie (Stabl.).

N.E. Highlands.—*Banff:* Tomintoul, per. (Miss Macv.).

Elgin: Banks of the Findhorn, 1848 (Croall): nr. Grantown (Miss Macv.); Dreggie Burn (Miss Macv.). *E. Inverness:* Laggantigown nr. Aviemore (Miss Macv.): Glenferness (Miss Macv.); Carr Bridge (Miss Macv.): Kincraig, cfr. (Miss Macv.).

W. Highlands. — *Kintyre:* Campbeltown (Ewing). *Clyde Isles:* Loch Ranza, v.c., on banks, fern roots, and trees (Macv.). *Dumbarton:* Arrochar, r.c. (Macv.); Tarbert (Macv.). *W. Stirling:* Inversnaid, r. (Macv.). *Argyll:* Puck's Glen, per. (A. Murr.); Coire Athoich, per. (A. Murr.); Glen Nant, u. (Macv.); head of Loch Awe, v.r. (Macv.); Loch Tulla, on stumps, r. (Macv.). *W. Inverness:* Moidart, c. (Macv.); Ardnamurchan, c. (Macv.); Sunart, c. (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Jura, cfr. (Ewing); Cairnmore Wood, Islay, cfr. (Gilm.); Kildalton Woods (Ewing). *Mid Inner Hebrides:* Nr. Tobermory (Kenn.); Achnadrish (Macv.).

Outer Hebrides.—Stornoway, cfr. (Gibs.).

Lower N. Highlands.— *W. Ross:* Strome Ferry (Macv.); Strathcarron (Macv.); Gairloch, per. (Miss Macv.). *E. Ross:* Achnasheen (Macv.); Fortrose, per. (Miss Macv.).

Upper N. Highlands. — *E. Sutherland:* Nr. Brora (Lillie). *Caithness:* Langwell (Lillie).

Orkney.—Hoy (Lillie).

Shetland.—Bressay (West).

var. gracilis *Carr.*

S.W. Lowlands.— *Wigtown:* Cairnryan (Macv.); Dunsky Glen (Macv.).

E. Lowlands.—*Linlithgow:* Niddrie Burn (M'And.).

S.E. Highlands. — *Fife and Kinross:* Humbie Wood (M'And.).

Lophocolea spicata *Tayl.*

Rare, and confined to the immediate neighbourhood of the west coast, except in one locality. Is most frequent in West Inverness, where it is frequent in wet crevices of rocks just above tide-mark. Is very rare in the south-west counties, having been found only in one ravine near the shore in Wigtownshire. Its eastern locality is in a ravine

close to the shore in Berwickshire. The species is probably to be found in many if not all of our western islands, but its small size makes its liable to be overlooked. Perianths and male inflorescence are common, but fruit has not been seen.

S.W. Lowlands.—*Wigtown:* Dunsky Glen, among *Lej. cavifolia* v. *heterophylla*, v.r. (Macv.).

E. Lowlands.—*Berwick:* Pease Dean, per., 1903 (M'And.).

W. Highlands.—*Clyde Isles:* Cave, Loch Ranza (Macv.). *W. Inverness:* Moidart, rocks on sea-shore, f., per., 1898 (Macv.).

Inner Hebrides.—*Mid Inner Hebrides:* Ceanavarra, Tiree, 1897 (Macv.).

Lophocolea heterophylla (*Schrad.*) *Dum.*

Distributed from Dumfries and Berwick to West Ross and Kincardine, but a rare species in general. It is frequent in a few localities of the West Lowlands, but is mostly rare. It is frequent in the East Lowlands, and is locally rather common. It is also rather frequent in Fife and the eastern part of the East Highlands; is rare towards its western boundary; and it is one of the rarest species in the West Highlands. North of the Clyde area, in the west of the country, it has not been found in its typical form, but only as the var. *paludosa* Warnst. on wet grassy ground. It has not been found in the Hebrides, and only in one locality in the North Highlands. It forms usually shallow patches on decaying logs in moist sheltered ground, and is confined to the low ground. Fruit is usually present from February to June.

S.W. Lowlands. — *Dumfries:* Moffat, per. (M'And.); woods nr. Dumfries (Scott). *Kirkcudbright:* Overton, per. (M'And.); Carroch Woods, per. (M'And.); White Loch, Colvend, per. (Ham.).

N.W. Lowlands.—*Renfrew:* Glen, Misty Law (Scott). *Lanark:* Cartland Crags (Evans).

E. Lowlands.—*Selkirk:* Near Faldonside, cfr. (Macv.). *Roxburgh:* Kelso, cfr. (Scott); Melrose, cfr., r. (Macv.). *Berwick:* Longformacus (Miss Macv.); Cockburnspath,

per. (M'And.). *Haddington:* Dunglass Woods, cfr., several places (Evans); Lennoxlove (Evans); Gullane Links, cfr. (M'And.). *Edinburgh:* Glencorse Woods (Evans); Bilston Glen (Evans); do., several places, per. (M'And.); Roslin Wood (Evans); Whitehill Glen, cfr. (Evans); Hermitage Glen, per. (M'And.); Ormiston Glen, per. (M'And.). *Linlithgow:* Dalmeny Woods, several places, per. (M'And.); Carriber Glen, cfr., several places (Evans).

S.E. Highlands. — *Fife and Kinross:* Raith, cfr. (Young); Begg Wood, cfr. (Young); Kinghorn, per. (Young); Cullalo (Evans); Humbie Wood (M'And.). *S. Perth:* Trossachs (Ewing); Muiravonside, cfr. (Evans); Causewayend, per. (Evans). *Mid Perth:* Kiltyrie, Killin (Macv.); Inver Wood, cfr. (M'In.).

Mid E. Highlands.—*Forfar:* Fern, 1875 (Ferg.); Emmock Wood (Aimer); Deer Hill Wood, cfr. (Aimer). *Kincardine:* Commonty, cfr. (Sim).

W. Highlands.—*Kintyre:* Campbeltown, per. (Ewing). *Clyde Isles:* Rothesay (M'And.). *Argyll:* Puck's Glen, cfr. (A. Murr.); Kilmun (Scott).

var. paludosa *Warnst.*

S.E. Highlands.—*E. Stirling:* Ridgehead Moss (Evans).
W. Highlands.—*W. Inverness:* Moidart, v.r. (Macv.).
Lower N. Highlands.—*W. Ross:* Gairloch (Miss Macv.).

CHILOSCYPHUS Corda

Chiloscyphus polyanthos (*L.*) *Corda*

A generally distributed and rather common species on the low ground. It is comparatively more common in the Lowlands than in the Highlands, and is rare on the hills. In some of the ravines of both East and West Lowlands it is very common, and continues common along the eastern side of the East Highlands. In some of the central districts and in the North Highlands it is frequent rather than common, and the same may be said throughout the West Highlands and Inner Hebrides. It forms thin, dark-green, extended patches on wet rocks, and occasionally on decay-

ing logs in ravines and in marshy places. It is found on schist, gneiss, basalt, granite, and sandstone, and sometimes also on limestone. Fruit is rather common from April to June.

S.W. Lowlands.—*Dumfries:* Dumfriesshire (Sir William Jardine in Grev. Herb.); Durisdeer (Scott); Moffat, several places (Johns.); do. (Miss Macv.). *Kirkcudbright:* Backwood, New Galloway (M'And.); The Dave (M'And.); Carsphairn, cfr. (West); Glentoo (G. West). *Wigtown:* Loch Ryan (Ewing).

N.W. Lowlands.—*Ayr:* Darvel (Ewing). *Renfrew:* Cloch (West); Glen, Misty Law (Scott). *Lanark:* Hamilton Woods (*cf.* Hopk. Fl. Glott., p. 140); Cartland Crags (Macv.); Lanark Loch (Macv.).

E. Lowlands.—*Peebles:* Cowie's Linn (Evans). *Selkirk:* Nr. Galashiels (Macv.); Henderland Burn (Macv.). *Roxburgh:* Nr. Melrose (Macv.). *Berwick:* Cockburnspath (M'And.). *Edinburgh:* Bilston Burn (G. Don *cf.* Hook. Fl. Scot., p. 116); Roslin Glen, cfr. (A. Murr.); Logan Burn (A. Murr.); Balerno (Macv.); Hillend Hill (Evans); Braid Hermitage, cfr. (Evans); Bilston Glen, cfr. (Evans). *Linlithgow:* Carriber Glen (Evans); Drumshoreland, cfr. (Evans); Cragiehall (M'And.).

S.E. Highlands.—*Fife and Kinross:* Raith (Young); West Lomond Hill (Evans); Keil's Den (M'And.). *E. Stirling:* Touch Moors (Croall). *S. Perth:* Loss Hill (K. & S.); Strathyre (Macv.). *Mid Perth:* Killin district, v. (Macv.). *N. Perth:* Craighall (Ferg.); Glen Thaitneich (Ferg.); Glen Beg, Glen Shee (Ferg.); Glas Meol (Stabl.).

Mid E. Highlands.—*Forfar:* (G. Don *cf.* Hook. Fl. Scot., p. 116); Dundee (Dickie); Sidlaw Hills, 1840 (Gard.); Moors of Dun, 1862 (Croall); The Burn (Croall); Leytack (Ferg.); Nathro (Ferg.); Fern (Ferg.); Head of Noran (Ferg.); Brandy Burn, Clova (Ferg.); Cruickside (Ferg.); Ravine of the Mourine (Croall). *Kincardine:* Gateside, Den of Garol, Blackhall, Letterburg, Strachan, Bowbutts (Sim). *S. Aberdeen:* Ballochbuie Forest (Stabl.); Lochnagar (Stabl.); Coire Ceandor (West).

N.E. Highlands.—*Elgin:* Dreggie Burn (Miss Macv.). *E. Inverness:* Kincraig (Miss Macv.).

W. Highlands.—*Clyde Isles:* Kyles of Bute (Ewing); Loch Ranza, R. (Macv.). *Dumbarton:* Allt Dubh Uisgue (Macv.); Arrochar (Macv.). *Argyll:* Nr. Taynuilt (Macv.); nr. Inch Chonain, Loch Awe (Macv.). *W. Inverness:* Choir Arder (Ferg.); Ben Nevis (Macv.); Moidart, F. (Macv.); Ardnamurchan, F. (Macv.); Sunart, F. (Macv.); Morar (West).

Inner Hebrides.—*S. Inner Hebrides:* Jura (Ewing); Machrie, Islay (Miss Evans); Kildalton Woods (Ewing). *Mid Inner Hebrides:* Nr. Tobermory (Kenn.).

N. Inner Hebrides.—Storr Rock (Ewing); Corrie, C. (Macv.); Ben Cailleach, R.C. to 1900 ft. (Macv.).

Outer Hebrides.—St Kilda (J. Waterston).

Lower N. Highlands.—*W. Ross:* Strome Ferry (Macv.); Strathcarron, C. (Macv.); Loch Maree (Miss Macv.).

Upper N. Highlands.—*E. Sutherland:* Nr. Loth (Lillie). *W. Sutherland:* Ben Clibreck (Lillie); Strathnavin (Lillie); Smoo Cave (Lillie). *Caithness:* Langwell (Lillie); Strath of Bilbster (Lillie).

Orkney.—Loch Stennis (Lillie).

Shetland.—Unst (Sim).

var. rivularis *Nees*

S.W. Lowlands.—*Kirkcudbright:* Rough Island (Ham.).

N.E. Lowlands.—*Ayr:* Largs (Ewing). *Renfrew:* Lochwinnoch (Ewing).

E. Lowlands.—*Peebles:* Nr. Leadburn (Evans). *Haddington:* Stream above Kidlaw Reservoir (Evans). *Edinburgh:* Nether Habbie's Howe (Evans).

S.E. Highlands.—*S. Perth:* Strathyre (Macv.). *Mid Perth:* Craig Vinean (M'In.).

W. Highlands.—*Dumbarton:* Loch Humphrey (Ewing). *W. Inverness:* Moidart (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Ardtalla Glen, Islay (Gilm.).

Chiloscyphus pallescens (*Schrad.*) *Nees*

A frequent species, but less generally distributed than *C. polyanthos*. It is occasionally locally more common than is the latter plant on the low ground, and it is the more

common species in Shetland and in elevated localities. It is uncommon on the hills, but is more frequent than the other plant, and ascends to 2800 ft. alt. in Mid Perth. It forms pale-green patches in springs, wet grassy ground, and on wet rocks. Fruit, mature from April to June, is uncommon.

S.W. Lowlands.—*Dumfries:* Sanquhar (Macv.). *Wigtown:* Stranraer (Macv.).

N.W. Lowlands.—*Lanark:* Lanark Loch (Macv.); Green Lowther (Macv.).

E. Lowlands.—*Haddington:* Gullane Links (M'And.); Traprain Law (M'And.). *Edinburgh:* Baads (Ewing). *Linlithgow:* Nr. Bathgate (Evans).

S.E. Highlands.—*Fife and Kinross:* Golland (Ewing); Glen Queich (Evans). *E. Stirling:* Touch Moors, in well, cfr. (Croall). *S. Perth:* Benclcuch, springs (Evans). *Mid Perth:* Cam Creag, alt. 2800 ft. (Macv.); Tyndrum (Macv.). *N. Perth:* Ben Gulabin (Ew. and Young).

Mid E. Highlands.—*Forfar:* Camlochan (Ew. and Young); Sidlaws (Aimer).

N.E. Highlands.—*E. Inverness:* Cairn Gorm, alt. 1200 ft. (Macv.).

W. Highlands.—*Clyde Isles:* Loch Ranza, on rocks (Macv.); Lamlash (M'And.); Whiting Bay (Miss Macv.). *Dumbarton:* Arrochar (Macv.); Loch Humphrey (Ewing). *Argyll:* Lochan Bhe (Macv.); Ben Arthur (Macv.). *W. Inverness:* Moidart (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Kildalton Woods (Ewing). *Mid Inner Hebrides:* Nr. Tobermory, on log in stream (Macv.).

Lower N. Highlands.—*W. Ross:* Strathcarron (Macv.).

Orkney.—Quoyawa, Hoy (Lillie).

Shetland.—Bressay (West); Unst (Lillie).

HARPANTHUS Nees

Harpanthus Flotowianus *Nees*

Is frequent on some of the higher hills in the East Highlands from 1800 ft. alt. to 3200 ft. alt.; otherwise it has only been found in a few localities. In Kirkcudbright

it has been found in a single and somewhat anomalous station at about 200 ft. alt. It has as yet been detected in the West Highlands only on Ben Nevis. In the North Highlands it has been found in two widely separated localities, the Caithness station being at about 500 ft. alt. It does not appear to be very rare in Shetland, as it has been found there on three occasions, and descending to nearly sea-level.

Grows in light, or sometimes dark, green tufts at the side of streamlets, on wet banks, and in marshy places. Female inflorescence is common, the male uncommon, and fruit has not been seen.

S.W. Lowlands.—*Kirkcudbright:* Glenlee Glen, New Galloway, among *Ceph. connivens* and *Calypogeia Trichomanis*, alt. *ca.* 200 ft., 1889 (M'And.).

S.E. Highlands.—*Mid Perth:* Ben Lawers, 1893 (H. J. Jameson *cf.* Pears. Hep. Brit., p. 263); do., several places from 2600–3200 ft. alt. (Macv.); Creag-an-Lochain, alt. 2000 ft. (Macv.); Ben Laoigh, alt. 1800 ft., and c. from 2300–2500 ft. alt. (Macv.): Am Binnean (Young). *North Perth:* Ben Gulabin, "frequent" (Ew. and Young).

Mid E. Highlands. — *Forfar:* Camlochan (Ew. and Young). *S. Aberdeen:* Craigindal, 1873 (Ferg.): Lochnagar, ♂ (Stabl.).

W. Highlands.—Ben Nevis, alt. *ca.* 2000 ft. (J. B. Duncan and H. H. Knight).

Lower N. Highlands.—*E. Ross:* Scuir na Lapaich, ♂ *forma* (Cocks).

Upper N. Highlands. — *Caithness:* Ousdale, alt. *ca.* 500 ft. (Lillie).

Shetland. — Burra Firth, Unst, 1878 (Sim *cf.* Pears. Hep. Brit., p. 263): Saxa Vord, Unst, and Unst without locality (Lillie); Loch of Girlsta, Nesting (Beeby); Bressay, with *Chiloscyphus* and *Scap. subalpina* (West).

Harpanthus scutatus (*Web. et Mohr*) *Spruce*

A rare species, but frequent on the coast of some parts of W. Inverness. It is confined to the low ground, and has been found only in a few localities close to the west

coast, except in one case where it occurs in a ravine some distance inland in Dumfriesshire. Usually occurs as light-green patches on moist peaty banks, and occasionally on logs.

Fruit is mature from May to July.

Scotland (G. Don *cf.* Hook. Brit. Jung., p. 41).

S.W. Lowlands. — *Dumfries:* Crichope Linn, on log with *Scap. umbrosa* (Macv.).

W. Highlands.—*Clyde Isles:* Loch Ranza, on banks, R. (Macv.); Lamlash (M'And.). *Argyll:* Scuir Dhearg, Ballachulish, with *Sphen. exsectæformis*, *Calypogeia Trichomanis*, and *Scap. umbrosa* (West). *W. Inverness:* Moidart, F., also cfr., 1898 (Macv.).

Lower N. Highlands.—*W. Ross:* Kyle, peaty banks on sea-shore (Macv.); Strathcarron R. (Macv.).

GEOCALYX Nees

Geocalyx graveolens (*Schrad.*) *Nees*

Known only as yet from one locality, accompanied by *Lepidozia reptans*, *Scapania gracilis*, *Calypogeia Trichomanis*, and *Mnium hornum*. This species may be expected to occur in other parts of Britain; it is liable to be mistaken in the field for *Lophocolea* or *Lophozia ventricosa*.

Lower N. Highlands.—*W. Ross:* Kyle, among shady rocks at the sea-shore, with perigynia, June 1902 (Macv.).

SACCOGYNA Dum.

Saccogyna viticulosa (*Sm.*) *Dum.*

This Atlantic species is generally distributed on the west coast, frequent in the western part of the East Highlands, but becoming very rare as it approaches the east coast. It is frequent in the West Lowlands, absent from the East Lowlands, and has only been found in one locality very sparingly on the east coast of the Highlands. It is only when one gets as far west as the Trossachs and Killin that this species is at all frequent; in fact, it has rarely been

found to the east of these districts. It is very common over all the West Highlands and in the Inner and Outer Hebrides; also common in West Ross and probably on the west coast of Sutherland. It is rare on the north coast, and has not been found to the east of Tongue. It approaches the east coast in Ross-shire, but has not been found in the east of Sutherland or in Caithness. It has been found in several places in Orkney and Shetland, where it appears to be rather common. There are other instances of Atlantic species being found in these islands though apparently absent from the well-searched Caithness.

This species is confined to the low ground, and grows in large, spreading, pale-green or yellowish patches on wet rocks, also creeping over mosses on moist banks, and sometimes erect in moss tufts. In the West Highlands and islands it is found in exposed as well as shady places, but when at any distance from the coast it only occurs in very sheltered ground, and chiefly in ravines. Sterile female inflorescence is frequent: no male inflorescence or fruit has been seen by the author in Scotland.

S.W. Lowlands. — *Dumfries:* Lochar Moss, 1840 (Cruicks.); nr. Langholm, among *Trichocolea* and *Plagiochila spinulosa*, 1866 (How.). *Kirkcudbright:* Glenlee Glen (M'And.); Glen Trool (Macv.). *Wigtown:* Dunsky Glen, F. (M'And.); Loch Ryan (Ewing); Craigoch Burn (Macv.); Portpatrick (Macv.); W. of Luce, above New Luce (Ewing).

N.W. Lowlands.—*Renfrew:* Langbank (Campb.); Inverkip (Lee); Glen, Misty Law (Scott); Cloch (West).

S.E. Highlands.—*Fife and Kinross:* Nr. Kinross, among *Metzgeria hamata*, 1844 (Stark)? *S. Perth:* Strathyre (Macv.); Trossachs, several places (Ewing and West). *Mid Perth:* Finlarig Burn (Ewing); do., R.C. (Macv.); Craig Vinean (M'In.).

Mid E. Highlands.—*Forfar:* Kinnordy, cfr. immature, April 1813 (Lyell *cf.* Carr. Brit. Hep., p. 45). *Kincardine:* Den of Lathers, a few stems among *Lejeunea cavifolia* and *Calypogeia fissa*, 1868 (Sim).

W. Highlands. — Loch Lomond, 1822 (Greville). *Kintyre:* Campbeltown (Ewing); Ronachan (Macrae);

Clachan, many places (Macrae); Tarbert (Ewing). *Clyde Isles:* Arran, 1843 (Gour.); Corrie (Ewing); Goatfell (Campb.); Loch Ranza (Campb.); do., c. (Macv.). *Dumbarton:* Ardlui, R.C. (Macv.); Arrochar, V.C. (Macv.). *W. Stirling:* Inversnaid (K. & S.); Rushnagh Glen, Rowardennan (K. & S.); Dubh Lochan nr. Rowardennan (K. & S.). *Argyll:* Dunoon (Lyon); Sandbank (Ewing); Puck's Glen (A. Murr.); Coire Athoich (A. Murr.); Loch Awe district, U. (Macv.); Kentallen (Macv.); Glen Ure (Kenn.). *W. Inverness:* Moidart, V.C. (Macv.); Ardnamurchan, C. (Macv.); Sunart, C. (Macv.); Coire Dheirg, Glen Nevis (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Jura (Ewing); Islay, several places, as Ardtalla, Ardbeg, Ardimersay, and Bridgend (Gilm.); Kildalton Woods (Ewing); Colonsay (M. M'Neill). *Mid Inner Hebrides:* Nr. Tobermory, several places (Kenn.); do., V.C., rocks and walls (Macv.); Dervaig (Macv.); Allt na Searmoin, C. (Kenn.). *N. Inner Hebrides:* Broadford district, C. (Macv.); Portree (Ewing).

Outer Hebrides.—Barra (Ewing); Benbecula (Ewing); Tarbert, several places (West).

Lower N. Highlands.—*W. Ross:* Ben Eay (How.); Strathcarron, C. (Macv.); Strome Ferry, C. (Macv.); Kyle, C. (Macv.); Loch Maree (Carr.). *E. Ross:* Loch Luichart (West).

Upper N. Highlands.—*W. Sutherland:* Tongue (Lillie).

Orkney.—Hoy, several places (West); do., F. (Lillie).

Shetland. — Neeans (Beeby); Outskerries (Lillie); Muckle Heog Cairns (Lillie); Loch of Cliff (Lillie).

CEPHALOZIA Dum.

Cephalozia bicuspidata (*L.*) *Dum.*

Generally distributed and common over all the country, both on the low ground and on the hills. Although common in the Lowlands, it is relatively less so than in the Highlands, as it requires a good deal of moisture in the soil, and this is frequently absent over considerable tracts of the former. It is very common in the Highlands and

Islands up to Shetland, and ascends to 3800 ft. alt. on Ben Nevis, and to at least 3500 ft. alt. in Mid Perth. It becomes, however, less frequent towards the higher parts of the hills. I have seen some hundreds of specimens, and from all the counties, so that its special distribution is not given.

This species grows in any moist position and on all our geological formations. It is one of the common plants of peat-mosses, and occurs frequently also on stumps and decaying logs. Fruit is usually present in spring, except in very wet ground. It is mature from February to June and July. Gemmæ are rare.

Cephalozia Lammersiana (*Hüben.*) *Spruce*

Widely distributed from Dumfries to Shetland, but uncommon. It is rare in the Lowlands and in at least some parts of both East and West Highlands, but its distribution apart from *C. bicuspidata* is imperfectly known. The author has found it to be uncommon in most of the districts which he has examined, though on the other hand in the most minutely searched district of Moidart he has found it to be frequent. Comparatively few specimens of the plant have been sent him from the various parts of Scotland, and the probability is that the plant is generally uncommon if not rare.

It prefers wetter ground than *C. bicuspidata*, and is usually found at the side of ditches and runnels, in marshy ground, and the wetter parts of peat-mosses. It nearly always grows unmixed. Though usually on the low ground, it ascends a considerable distance up the hills, but rarely above 2000 ft. alt. It occurs on a wet rock on Ben Nevis at 3600 ft. alt. Perianths are common, but fruit is rather uncommon.

S.W. Lowlands.—*Dumfries:* Crawick Water, on rotten wood, cfr. (Macv.). *Kirkcudbright:* Blackcraig, New Galloway, per. (M'And.). *Wigtown:* Knowe (Ewing).

N.W. Lowlands.—*Ayr:* Largs (Ewing); Fairlie, per. (Ewing); Ladyland, per. (Scott). *Renfrew:* Loch Thom, per. (Ewing). *Lanark:* Falls of Clyde, per. (Ewing).

E. Lowlands.—*Peebles:* Cowie's Linn, per. (M'And.). *Berwick:* Cockburnspath (M'And.). *Edinburgh:* Hawthornden, per. (M'And.); Corstorphine Hill, per. (M'And.). *Linlithgow:* Drumshoreland (Evans); Fauldhouse Moor (Evans); Carriber Glen, per. (M'And.); Craigiehall Wood (M'And.).

S.E. Highlands.—*Fife and Kinross:* Begg Wood, per. (Young); West Lomond Hill, per. (Evans); Charlestown, ♂ (M'And.). *Mid Perth:* Ben Lawers, per. (Scott).

Mid E. Highlands.—*Kincardine:* Linn of Dye (Sim); Den of Garol (Sim). *S. Aberdeen:* Glen Beg, Braemar (Stabl.); Lochnagar (Ewing).

N.E. Highlands.—*Elgin:* Above Sluie, 1848, per. (Croall). *E. Inverness:* Nr. Kinveachy, Boat of Garten, per. (Miss Macv.).

W. Highlands.—*Kintyre:* Campbeltown (Ewing). *Dumbarton:* Milngavie (Ewing). *W. Stirling:* Dubh Lochain nr. Rowardennan (K. & S.). *Argyll:* Puck's Glen, per. (A. Murr.); nr. Loch Awe Station, ♂ (Macv.). *W. Inverness:* Moidart, f. (Macv.); Ben Nevis, alt. 3600 ft. (Macv.).

Inner Hebrides.—*Mid Inner Hebrides:* Ben More (Ewing). *N. Inner Hebrides:* Mill Burn, Broadford, per. (Macv.).

Outer Hebrides.—Tarbert, per. (West).

Lower N. Highlands.—*W. Ross:* Strathcarron, per. (Macv.); Loch Maree, per. (Miss Macv.).

Upper N. Highlands.—*Caithness:* Langwell Deer Forest, per. (Lillie); Ousdale, per (Lillie).

Orkney.—Kirkwall, per. (West).

Shetland.—Lerwick (Sim); Yell (Sim).

Cephalozia pleniceps (*Aust.*) *Lindb.*

This alpine species has been found only in a few of our hills from Perthshire to Caithness; it has not yet been found on the west side of the country. It forms small patches on moist rock ledges and banks, descending to 1800 ft. alt. in Mid Perth. Fruit is common.

S.E. Highlands.—*Mid Perth:* Craig-an-Lochain, alt. 1800 ft., per., 1900, and in another station, alt. *ca.* 2000 ft.,

cfr., 1901 (Macv.); Ben Heasgarnich, cfr. (Young); Ben Lawers, per. (H. H. Knight); Meall Garbh, Rannoch, alt. *ca.* 2500 ft. (W. E. Nicholson). *N. Perth:* Glen Thulachan, cfr., 1879 (Ferg.); Meal Uaine, cfr. with *C. bicuspidata* (Ferg.); Ben Gulabin, per. (Ew. and Young).

Mid E. Highlands.—*Forfar:* Glen Fee, cfr., alt. 2300 ft., 1876 (Ferg.).

Upper N. Highlands.—*W. Sutherland:* Ben Clibreck, per. with *Ceph. bicuspidata*, above 2000 ft. alt., 1903 (Lillie).

Cephalozia connivens (*Dicks.*) *Spruce*

Widely distributed from Dumfries to Shetland. As it is usually found in peat-mosses, its distribution is local. This especially affects the Lowlands, where peat-mosses are scarce, but it has been found frequent in most of those examined. In the Highlands this species is frequent. It is also found, though more rarely, on wet banks and sides of streams and on stumps.

It is usually sterile, but when occurring in compact tufts perianths are not rare. Fruit, which is mature from March to June, has been seldom noticed.

S.W. Lowlands.—*Dumfries:* Moffat (Miss Macv.); Sanquhar Moor, f. (Macv.). *Kirkcudbright:* Nr. Knockmarling (M'And.); Glenlee Glen (M'And.); Barend Moss (M'And.); Glen Trool (Macv.). *Wigtown:* Craigock Park Moor (M'And.).

N.W. Lowlands.—*Ayr:* Carfine (Kids.). *Renfrew:* Nr. Loch Thom (West). *Lanark:* Elvanfoot district, f. in peat-mosses (Macv.); Kirk Burn, Tinto (Macv.).

E. Lowlands.—*Peebles:* Moor nr. Cowie's Linn (Evans); moss nr. Leadburn (Evans); Tweedsmuir, per. (Macv.). *Selkirk:* Nr. Tushielaw (Evans). *Berwick:* Nr. Seenes Law (Evans). *Edinburgh:* Balerno Moss, f. (Macv.); Pentlands, cfr. (Evans). *Linlithgow:* Fauldhouse Moor (Evans).

S.E. Highlands.—*Fife and Kinross:* Begg Wood (Young); Moss Morran (Young). *E. Stirling:* Ridgehead Moss (Evans). *Mid Perth:* Achrioch Wood, among *Leptocyphus anomalus* (Macv.). *N. Perth:* Ben Gulabin (Ewing and Young).

Mid E. Highlands.—*Forfar:* Long Marsh, Sidlaw Hills (Aimer). *Kincardine:* Tillylair, among *Leptocyphus anomalus* (Sim). *S. Aberdeen:* Lochnagar (Stabl.). *N. Aberdeen:* Mormond Hill (Ewing).

N.E. Highlands.—*E. Inverness:* Carn Dearg, Aviemore, per. (Macv.); Loch Vaa, on a stump (Miss Macv.); moor nr. Carr Bridge (Miss Macv.); Boat of Garten (Miss Macv.).

W. Highlands.—*Clyde Isles:* Loch Ranza, c. (Macv.). *Dumbarton:* Ben Vorlich, alt. 2100 ft., per. (Macv.) *Argyll:* Lochan Bhe (Macv.). *W. Inverness:* Moidart, f. (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Carnmore Wood, Islay (Gilm.); Kildalton Woods (Ewing). *Mid Inner Hebrides:* L. Mishnish (Macv.); L. Frisa (Macv.). *N. Inner Hebrides:* Nr. Broadford, Skye (Macv.).

Outer Hebrides.—Balallan (West).

Lower N. Highlands.—*W. Ross:* Strathcarron, f. (Macv.). *E. Ross:* Achnasheen (Macv.).

Upper N. Highlands.—*E. Sutherland:* Strath Ullie (Lillie); nr. Ben Roscie (Lillie). *W. Sutherland:* Forsinard (Lillie); Ben Laoghal (Lillie). *Caithness:* East Watten Moss, per. (Lillie); Ben Rha, Reay, per. (Lillie).

Orkney.—Kirkwall (West).

Shetland.—Yell (Sim); Unst (Sim).

Cephalozia lunulæfolia *Dum.*

C. media Lindb.
C. multiflora Spruce

Widely distributed from Dumfries to Orkney, but rather uncommon in general. It is uncommon in both West and East Lowlands and in Fife, though frequent in some peat-mosses and on the peaty banks above 1000 ft. alt. of some of the Southern Uplands. Is rare towards the coast of the East Highlands, and uncommon in most of the hilly districts of that province. It is common in many parts of the West and North Highlands and Hebrides. Is very rare in Orkney and has not been found in Shetland. The distribution of this plant is largely a question of the presence of peaty soil, but it is less general throughout the peaty parts of the country than is *C. connivens*, and it seems to prefer the peat when in the moist climate of the west side of

Scotland. It is less dependent on a large amount of moisture than is *C. connivens*, and it is a frequent species on decaying logs and stumps in some ravines in the Lowlands, and in less sheltered ground, as well as in ravines, in the wetter parts of the Highlands. It is seldom found above 1000 ft. alt., except in the Southern Uplands, where it has been found to 1900 ft. alt. It grows in dark-green, compact tufts or cushions on soil, in thin patches on logs, and as scattered stems in peat-mosses. Perianths are common, and fruit, which is mature from April to August, is frequent and not rarely rather abundant. Gemmæ are very common.

S.W. Lowlands.—*Dumfries:* Without other locality (*cf.* Spruce On Ceph., p. 39); Crichope Linn, c. (Macv.); Gallow Hill, Moffat (Miss Macv.); Archbank, Moffat (Miss Macv.). *Kirkcudbright:* Routing Bridge, 1840 (Gray); Bennan Hill (M'And.); side of R. Ken (M'And.); Glen Trool (Macv.).

N.W. Lowlands.—*Ayr:* Carfine (Kids.); Barskimming Moor (Scott). *Lanark:* Wilsontown, per. (Ewing); Tinto, alt. 1000 ft. (Macv.); Elvanfoot peat-mosses, f. (Macv.); Lousie Wood Law, 1700–1900 ft., f. (Macv.).

E. Lowlands.—*Peebles:* Cowie's Linn, per. (Evans); Logan Water, alt. 1250 ft. (Macv.); Tweedsmuir, per. (Macv.). *Selkirk:* Glenkinnon Burn (Macv.); nr. Faldonside (Macv.). *Roxburgh:* Rhymer's Glen, Melrose, u. (Macv.); Abbotsford Woods (Macv.). *Berwick:* Cockburnspath (M'And.). *Haddington:* Dunglass (M'And.); Dunbar Common and Lammermuir Hills (Evans). *Edinburgh:* Roslin Glen, per. (A. Murr.); Balerno Moss (A. Murr.); Harperrig Reservoir (Evans); Baads, per. (Ewing). *Linlithgow:* Crawhill (Evans).

S.E. Highlands.—*Fife and Kinross:* Lomond Hills (Young); Cullalo (Evans); Aberdour (M'And.). *E. Stirling:* Wester Glen, Gargunnock (K. & S.); Rowardennan, per. (M'And.). *S. Perth:* Nr. Doune (K. & S.); Trossachs (Ewing); Blair Drummond (Evans). *Mid Perth:* Achrioch Wood (Macv.). *N. Perth:* Carn Lochain Glen (Stabl.); Ben Gulabin (Ewing and Young).

Mid E. Highlands.—*Forfar:* Clova (Aimer). *Kincar-*

dine: Stonehaven, per. (M'And.). *N. Aberdeen:* Balmoral, per. (Stabl.); Glen Beg, Balmoral (Stabl.); Corriemulzie (Stabl.). *N. Aberdeen:* Mormond Hill (Ewing).

N.E. Highlands.—Glen Beg nr. Grantown (Miss Macv.). *E. Inverness:* Carr Bridge (Miss Macv.); moor above Insh (Miss Macv.).

W. Highlands.—*Kintyre:* Ronachan (Macrae); Clachan (Macrae); Tarbert (Ewing). *Clyde Isles:* Bute (Ewing); Loch Ranza, c., cfr. (Macv.). *Dumbarton:* Craigmaddie (Campb.). *Argyll:* Benmore, per. (A. Murr.); Loch Tulla, f. (Macv.); Balliveolan Burn (Kenn.). *W. Inverness:* Moidart, c. (Macv.); Ardnamurchan, c. (Macv.); Sunart, c. (Macv.); Ben Nevis (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Jura (Ewing); Ardbeg, Islay (Gilm.); Ardimersay, per. (Gilm.); Kildalton Woods (Ewing). *Mid Inner Hebrides:* Nr. Tobermory (Kenn.); Allt na Searmoin (Kenn.).

Outer Hebrides.—Tarbert, several places (West).

Lower N. Highlands.—*West Ross:* Kyle, r.c. (Macv.); Strome Ferry (Macv.); Strathcarron (Macv.). *E. Ross:* Achnasheen (Macv.).

Upper N. Highlands.—Sutherland (Grev. *cf.* Pears. Hep. Brit., p. 149). *Caithness:* Latheron (Lillie); Dorrery, per. (Lillie); Ousdale, per. (Lillie); Morven (Lillie).

Orkney.—Trowie Glen, Hoy (Lillie).

Cephalozia leucantha *Spruce*

Widely distributed in the subalpine region from Dumfries to Shetland. It is rare in the Lowlands, except on the peaty hills of the Southern Uplands, where it is frequent. Is uncommon in the East Highlands, especially towards the coast. It is rather common in various parts of the West Highlands and Hebrides, and is common in the North Highlands and in Shetland. Although frequently occurring on stumps and decaying logs, especially in the Lowlands and East Highlands, it is much more commonly found on peaty soil in peat-mosses or banks and ditch-sides, and is often associated with *Lepidozia setacea* and *L. trichoclados*. The highest altitudes at which it has so far been found are 1900 ft. alt. in the Lowlands and 1600 ft. alt. in Mid Perth.

It is frequent at sea-level on the west side of the Highlands. Perianths are frequent, but fruit, which is mature from April to June, is rather uncommon.

S.W. Lowlands.—*Dumfries:* Gallow Hill, Moffat, on decaying wood, per. (M'And.); Archbank, Moffat, on peat (Miss Macv.); Sanquhar Moss, per. (Macv.). *Kirkcudbright:* Garroch Loch, cfr. (M'And.). *Wigtown:* Knowe, on old wood, cfr. (Ewing).

N.W. Lowlands.—*Lanark:* Tinto, alt. 1900 ft. (Macv.); Elvanfoot, peat-moss, f. (Macv.); Lousiewood Law, 1700–1900 ft., f. (Macv.)

E. Lowlands.—*Peebles:* Logan Water, cfr., alt. 1250 ft. (Macv.); Carton Burn, l.c. at side of sheep-drains, alt. 1200 ft. (Macv.); Tweedsmuir, alt. *ca.* 900 ft. (Macv.). *Haddington:* Lammer Law, alt. *ca.* 1600 ft. (Evans); above Gifford, on wet, peaty ground, per. (Evans). *Edinburgh:* Baads (Ewing).

S.E. Highlands.—*S. Perth:* Trossachs, on rotten wood (Ewing). *Mid Perth:* Lochan-na-Lairige, alt. 1600 ft., boggy ground (Macv.); Achrioch Wood, c. on stumps, also on side of ditch, cfr. (Macv.). *N. Perth:* Glas Thaitneich, 1879 (Ferg.); Drumlochy, on decaying mosses, etc. (Ferg.); Ben Gulabin (Ewing and Young).

Mid E. Highlands.—*Kincardine:* Kerloch, 1870 (Sim); Den of Garol, with *Lepidozia setacea* and *Odontoschisma Sphagni* (Sim); Stonehaven, on decaying wood (M'And.). *S. Aberdeen:* Potarch, per. (Sim). *N. Aberdeen:* Mormond Hill, on soil (Ewing).

N.E. Highlands.—*E. Inverness:* Carr Bridge, on fir stump (Miss Macv.); moor above Insh (Miss Macv.).

W. Highlands.—*Kintyre:* Tarbert, on peaty soil (Ewing); between Ardrishaig and Tarbert (Ewing). *Clyde Isles:* Loch Ranza, with *Lepidozia setacea* (Macv.). *Argyll:* Nr. Loch Awe Station, on decayed fern roots (Macv.). *W. Inverness:* Moidart, r.c. (Macv.); Ardnamurchan (Macv.); Sunart (Macv.).

Inner Hebrides.—*Mid Inner Hebrides:* Allt na Searmoin (Kenn.). *N. Inner Hebrides:* Corrie, Skye, on peaty soil (Macv.).

Outer Hebrides.—Benbecula (West); Balallan (West); Tarbert (West).

LOWER N. HIGHLANDS.—*W. Ross:* Kyle, c. on peaty banks (Macv.): Strathcarron, on decaying log, and in several places on peaty soil (Macv.).

UPPER N. HIGHLANDS.—*E. Sutherland:* Strath Ullie (Lillie); nr. Garvalt (Lillie). *W. Sutherland:* Strath Halladale (Lillie); Ben Clibreck, on soil, per. (Lillie); between Durness and Tongue, several places on soil (Lillie). *Caithness:* Several places, as Morven, East Watten Moss, per., Pennyland, Watten, cfr., and West Dunnet Hill, per. (Lillie).

ORKNEY.—Stromness (West); Kirkwall (West).

SHETLAND.—Unst, per. (Sim); Yell (Sim); Clousta (Grieve); Reawick, per. (Sim); Unst (Lillie).

CEPHALOZIA PALLIDA *Spruce*

Has only been found in three localities in the Lowlands, on peaty soil. Fruit is mature in June.

S.W. LOWLANDS.—*Dumfries:* Crichope Linn, among *Lepid. trichoclados*, per., Aug. 1887 (Scott); do., cfr. (Macv.). *Kirkcudbright:* Dalveoch Glen, New Galloway, per., 1890 (M'And.).

E. LOWLANDS.—*Edinburgh:* Cobbinshaw Moss (Evans).

CEPHALOZIA SERRIFLORA *Lindb.*

C. reclusa (Tayl.) Dum. p.p.
C. catenulata Spruce

Occurs on logs and stumps in shady places. Has only been found in a very few localities in the East and West Highlands, with the possible exception of one station in the East Lowlands. The plant of the last locality is somewhat doubtful, as it is without female bracts and the leaves are not typical.

E. LOWLANDS.—*Linlithgow:* Dalmeny, on peat, *forma*, with *C. connivens*, 1898 (Young).

MID E. HIGHLANDS.—*Forfar:* Fern, on rotting wood, with *Loph. cuspidata* and *Scap. umbrosa*, 1876 (Ferg.) *S. Aberdeen:* Balmoral, 1884 (Stabl.).

W. HIGHLANDS.—*Argyll:* Balliveolan Burn, L. Creran,

on log, 1908 (Kenn.). *W. Inverness:* Moidart, v.r., Allt a Mhuillin, on a log in ravine, 1897, and Caolis Burn, on stump with *Nowellia curvifolia*, per. (Macv.); Sunart, Resipol Burn, in ravine, on log with *Aneura palmata* and *Nowellia curvifolia* (Macv.); Glen Nevis, on log with *Nowellia curvifolia*, etc. (H. H. Knight).

Cephalozia Francisci (*Hook.*) *Dum.*

Very rare, and only known from a few localities in the Highlands. It has been recorded from Dumfries by Cruickshank, but that botanist's specimen in Herb. Dickie is not this species. The localities known as yet are too few to allow any particular character to be given to its distribution, though it is apparently more frequent in the East Highlands than in the West. It is certainly very rare over all the West Highlands, and it has not been found in the Hebrides or in the extreme north. The stations for it are all in the subalpine region, and are either on moist peaty banks on the lower slopes of the hills, or at the sides of roadside drains in peaty districts. It forms small reddish-brown patches. Perianths appear to be uncommon, and fruit, mature in June and July, is rare. Gemmæ are abundant.

S.E. Highlands.—*Mid Perth:* Bank on roadside, Tyndrum, alt. *ca.* 1000 ft. (Macv.); Ben Odhar, on bank, alt. 1200 ft. (Macv.); Finlarig Wood (Young).

Mid E. Highlands. — *Forfar:* Balquharn, Fern, alt. 600 ft., 1879 (Ferg.); moor nr. Monikie (Ferg.). *Kincardine:* Baikie Wells, Strachan, 1880 (Sim). *S. Aberdeen:* Lochnagar, per., 1876 (Sim); Peter's Hill, Birse, per., with *Ceph. bicuspidata* (Sim).

W. Highlands. — *Clyde Isles:* Glen Chalmadale, L. Ranza, on side of roadside drain nr. peat-moss, with *C. bicuspidata* (Macv.). *Argyll:* Ben Cruachan, north side, on bank, alt. *ca.* 400 ft. (Macv.); nr. Lochan Bhe, on banks, cfr., f. (Macv.).

Lower N. Highlands.—*W. Ross:* Strathcarron, roadside drain (Macv.).

Cephalozia fluitans (*Nees*) *Spruce*

Widely distributed from Kirkcudbright to Caithness, but rare. As it usually occurs with us as scattered stems among *Sphagnum*, it is probably sometimes overlooked, yet in well-searched districts it has only been found in small quantities. It is certainly rare in the West Highlands, and it has not been found in the Hebrides. It has been gathered in greater quantity in Caithness than elsewhere. The localities are all on low-lying peat-mosses, the highest altitude being 1200 ft. in Mid Perth. It is occasionally found in pale-green submerged masses in pools on moors. The plant is usually without inflorescence, though sterile female inflorescence has been seen. This species fruits in the north of England in June.

S.W. Lowlands.—*Kirkcudbright:* Barend Moss, 1882 (M'And.).

E. Lowlands.—*Edinburgh:* Balerno Moss (M'And.); do. (Evans).

S.E. Highlands. — *Mid Perth:* Glen Lochy, among *Pleurozia* (Young); Ben Odhar, alt. *ca.* 1200 ft. (Macv.); Ben Chuirm (Ewing).

Mid E. Highlands. — *S. Aberdeen:* Lochnagar, 1856 (Croall).

W. Highlands.—*W. Inverness:* Moidart, R. (Macv.); Ardnamurchan, R. (Macv.).

Lower N. Highlands.—*W. Ross:* Strathcarron Moss (Macv.). *E. Ross:* Achnasheen (West).

Upper N. Highlands. — *W. Sutherland:* Nr. Hope Bridge (Lillie). *Caithness:* Rumster (Lillie); nr. Kensary (Lillie); Badlybster (Lillie).

NOWELLIA Mitt.

Nowellia curvifolia (*Dicks.*) *Mitt.*

Cephalozia curvifolia (Dicks.) Dum.

Widely distributed from Dumfries to Orkney and Shetland, but mostly uncommon. Is rather rare in the Lowlands and Fife, and in most parts near the coast of the

East Highlands, though found in some quantity in the inland parts of the latter province where there are old fir-woods. It is rather common in the West Highlands and in some parts of the Hebrides, also in West Ross, but it has not been found in the extreme north of the mainland. It has been collected on one occasion in Orkney. The only Shetland specimen was small and is not available for re-examination, and it is just possible that it may have been a form of *C. bicuspidata*. It is confined to the low ground and has not been found above 1200 ft. alt. On the east side of the country this species nearly always occurs on decaying logs and stumps in moist, well-sheltered ground. This is also usually the case in the West Lowlands, but in the West Highlands and Islands it frequently is also found on moist, bare peat on moors, shelter not being necessary in the moist climate of the west. In districts where there are old fir-woods as well as deciduous trees this species appears to prefer the decaying logs and stumps of the former, but in those districts without old fir-woods it is quite at home on deciduous wood. Fruit, mature from May to August, is common when on wood, but has not been met with when on peat.

In Alpibus Scoticis (Dicks. *cf.* Pl. Crypt. Fasc., ii., p. 15, 1790).

S.W. Lowlands. — *Dumfries:* Moffat, per. (M'And.); Beld Craig, cfr. (M'And.). *Kirkcudbright:* Glenlee Glen, per. (M'And.). *Wigtown:* Castle Kennedy, stumps, cfr. (Macv.).

N.W. Lowlands.—*Ayr:* Carfine (Kids.); Barskimming Moor (Scott). *Renfrew:* Glen, Misty Law, on decaying wood (Scott). *Lanark:* Cadder (Wilkie); Cadzow, per. (J. Murr.); Falls of Clyde, per. (Ewing).

E. Lowlands.—*Peebles:* Cowie's Linn (A. Murr.); near Peebles (Hunter). *Selkirk:* Glenkinnon Burn, on log, R. (Macv.). *Roxburgh:* Rhymer's Glen, Melrose, on stumps, U. (Macv.). *Edinburgh:* Glencorse Woods (Evans); Bavelaw Wood (Evans); Redford Wood (A. Murr.); Bilston Glen (Evans); Ravensworth nr. Penicuik (Evans). *Linlithgow:* Carriber Glen, cfr. (A. Murr.).

S.E. Highlands.—*Fife and Kinross:* Raith (Young);

Otterston Loch, on wood (M'And.). *E. Stirling:* Wester Glen, per. (K. & S.); Barton Burn (K. & S.). *S. Perth:* Trossachs, several places, also per. (Ewing and West). *Mid Perth:* Killin, c. on decaying logs, also cfr. (Macv.); Achrioch Wood, r. (Macv.); Inver Wood, per. (M'In.). *N. Perth:* Den of Balthayock, 1848 (Gard.? in Ed. Herb.).

Mid E. Highlands.—*Forfar:* Fern, cfr. (Ferg.); Noran (Ferg.); Deer Hill Wood, on stump, cfr. (Aimer). *Kincardine:* Blackhall, cfr., 1879 (Sim). *S. Aberdeen:* Balmoral, Ballochbuie, and Abergeldie (Stabl.).

N.E. Highlands.—*E. Inverness:* Carr Bridge, on fir stump (Miss Macv.).

W. Highlands.—Loch Lomond (*cf.* Spruce on Ceph., p. 49). *Kintyre:* Tarbert (Ewing); nr. Lochgilphead (Ewing). *Clyde Isles:* Goatfell, on wood (Ewing). *Dumbarton:* Moor between Gairloch and Loch Long (Scott); nr. Loch Long (Scott). *Argyll:* Benmore (A. Murr.); nr. Ballachulish, on logs (Macv.); Ben an Dothaidh, on soil *ca.* 1200 ft. alt. (Ewing and Macv.); Balliveolan Burn, on log (Kenn.). *W. Inverness:* Glenfinnan, 1876 (Carr.); Moidart, r.c. (Macv.); Ardnamurchan (Macv.); Sunart (Macv.).

Inner Hebrides.—*Mid Inner Hebrides:* Nr. Tobermory, cfr. (Kenn.); L. Frisa, on peat (Macv.); Allt na Searmoin (Kenn.).

Outer Hebrides.—Tarbert (West); Balallan (West).

Lower N. Highlands.—*W. Ross:* Strathcarron Moss, c. (Macv.). *E. Ross:* Without nearer locality, 1872 (Barker).

Orkney.—Hoy (West).

Shetland.—Uni Firth, on dead twigs at side of peat hole (Grieve)?

HYGROBIELLA Spruce

Hygrobiella laxifolia (*Hook.*) *Spruce*

Widely distributed from Dumfries to Shetland. It is rare in the West Lowlands and descends to 300 ft. alt., the only locality where it can be considered at all frequent being among the hills in Kirkcudbright; is very rare in the Upper Clyde district. It has not been found in the

East Lowlands or in Fife, though it might be expected to occur in the Talla district of the Tweed. It is frequent in the subalpine region of the East Highlands, and is rather common on the hills, ascending to 3400 ft. alt. in Mid Perth. It is also frequent on the lower slopes of the hills in the West Highlands to sea-level, and in the Inner Hebrides, but is rare on the higher levels. It has only been found in a few localities in the North Highlands, probably in some measure owing to its small size causing it to be overlooked, as it has been found in several places in Shetland. It has, however, not been found in Orkney or Caithness. It occurs in both schistose and granite formations, and is very common in one limestone region in Skye. It forms dark-green or nearly black patches on wet rocks, most frequently at the sides of streams, also occasionally on soil on damp roadsides. It is commonly unmixed, though frequently among mosses. Perianths are usually present, and fruit is not rare, especially when in elevated localities.

S.W. Lowlands.—*Dumfries:* Crichope Linn, r. (Macv.). *Kirkcudbright:* Lowran Burn (M'And.); Knockmarling Burn, per., alt. *ca.* 300 ft. (M'And.); Glen Trool, ♂ (Macv.).

N.W. Lowlands.—*Ayr:* Ladyland, per., among *Nardia obovata*, etc. (Scott). *Lanark:* Stream S. of Elvanfoot, v.r. (Macv.).

S.E. Highlands.—*S. Perth:* Ben Venue (Carr. *cf.* Pears. Hep. Brit., p. 199); Strathyre (Macv.). *Mid Perth:* Killin district, c. both on low ground and on the hills to 3400 ft. alt., cfr. u. (Macv.); Ben Heasgarnich (Ewing); Tyndrum district, c. both on low ground and on the hills, as Ben Laoigh, Ben Dubh Craige, and Ben Odhar (Macv.); Glen Dochart (Young); Am Binnean (Ewing). *N. Perth:* Glen Tilt, alt. 1500 ft. (Ferg.); Glen Sochaidh (West); Glen Beg, Glen Shee, ♂ (Ferg.); Glen Thaitneich, per. and ♂ (Ewing and Young).

Mid E. Highlands.—*Forfar:* Auchphersie (Ferg.); above Afflochie, alt. 1200 ft. (Ferg.). *Kincardine:* Clochmaben nr. Banchory, cfr. (Sim *cf.* Spruce On Ceph., p. 75); Dalfro Bog (Sim). *S. Aberdeen:* Loch Kellerton, per., 1842 (Dickie); Peter's Hill, Birse, per. (Sim); nr. Potarch, per. (Sim) Lion's Face, Braemar (Stabl.).

N.E. HIGHLANDS.—*Banff:* Head of Glen Avon, 1855 (Croall). *Elgin:* Dreggie Burn nr. Grantown (Miss Macv.).

W. HIGHLANDS.—*Clyde Isles:* Loch Ranza, R. (Macv.). *Dumbarton:* Ben Vorlich (Macv.); Manse Burn, etc., Arrochar, cfr. (Macv.). *W. Stirling:* Inversnaid (Macv.). *Argyll:* Dalmally (E. George *cf.* Pears. Hep. Brit., p. 199); head of Loch Awe, per., U. (Macv.); Coire Ghlais, Ben Cruachan, alt. 1200 ft. (Macv.); Tailor's Leap, Glen Nant, per. (Macv.); Ben Doureann (Ewing and Macv.); Ben Fhada, Glencoe (West). *W. Inverness:* Glenfinnan (Carr. *cf.* Pears. Hep. Brit., p. 199); Glen Nevis, roadside (Macv.); Moidart, R.C. (Macv.); Ardnamurchan, R.C. (Macv.); Sunart, R.C. (Macv.).

INNER HEBRIDES.—*Mid Inner Hebrides:* Ben More (Kenn.). *N. Inner Hebrides:* Ben Cailleach, alt. 400 ft. (Macv.); Mill Burn, Broadford, V.C., also per. V.C. (Macv.).

LOWER N. HIGHLANDS.—*W. Ross:* Strathcarron, U. (Macv.). *E. Ross:* Achnasheen (Macv.).

UPPER N. HIGHLANDS.—*W. Sutherland:* Strath Halladale, per. (Lillie).

SHETLAND.—Northmaven (Sim); Burn of Vallor (Sim); Unst, per. (Sim); Ronas Hill, per. and ♂ (Sim).

EREMONOTUS (Lindb. et Kaal.) Pears.

EREMONOTUS MYRIOCARPUS (*Carr.*) *Pears.*

Rare, and only known from a few counties in the Highlands from South Perth to Orkney. It is more frequent on the hills of Mid Perth than elsewhere, and has been found in several places on the west side of the Highlands. Although it has not been detected in the Eastern Grampians, it doubtless occurs there. It has only so far been found in one locality in the North Highlands, but no doubt it will be found in others. It occurs near sea-level in the West Highlands, and at under 100 ft. alt. in the North Highlands. In Mid Perth it has been found from about 900 ft. to 3900 ft. alt., being most frequent above 1500 ft. alt. Forms small dark-coloured patches on wet rocks and on soil-covered rocks, usually at the side of streams. Exception-

ally it occurs in large reddish-brown cushions on rather drier rocks. It has been found in most quantity where there is some lime, though it is also found on purely schistose rocks. Perianths are rather uncommon, and fruit, mature in June, is rare.

S.E. Highlands.—*S. Perth:* Ben Venue, 1876 (Carr. *cf.* Trans. Bot. Soc. Ed., p. 466, 1880); Strathyre, with *Hygrob. laxifolia* (Macv.). *Mid Perth:* Ben Lawers, per., alt., 3900 ft. and alt. 3900 ft. (Macv.); Craig-an-Lochain, alt. *ca.* 2000 ft. (Macv.); Cam Chreag (Macv.); Craig Chailleach, alt. 2500 ft., with *Haplozia atrovirens* (Macv.); Ben Dubh Craige (Macv.); Ben Odhar (Macv.); Clifton Burn, with *Haplozia atrovirens* (Macv.); Ben Heasgarnich (Young).

W. Highlands.—*Argyll:* Meal Odhar, Glen Lochy, cfr. (Ewing and Macv.); Ben Doureann, per., with *H. laxifolia* (Ewing and Macv.). *W. Inverness:* Moidart, several places with *Hygrob. laxifolia* (Macv.).

Inner Hebrides.—*N. Inner Hebrides:* Mill Burn, Broadford, per (Macv.).

Lower N. Highlands.—*E. Ross:* Loch Luichart, per. (West).

Orkney.—Ward Hill, Hoy, among *Scap. purpurascens* (Lillie).

PRIONOLOBUS Spruce

Prionolobus Massalongi (*Spruce*) *Schiffn.*

This rare species has only been found in one locality in Scotland, and in the south of England. The Scottish specimen was determined by Schiffner, but Douin names our plant *Cephaloziella Nicholsoni* as being distinct from Spruce's species.

Mid E. Highlands.—*Kincardine:* Mount Shade, on *Frull. fragilifolia*, 187(7 ?) (Sim).

Prionolobus striatulus (*Jens.*) *Schiffn.*

Cephalozia striatula Jens.

This rather recently described species is at present confined in Britain to the locality given below, where it forms thin patches straggling over compact *Sphagnum*

tufts, and especially over those parts of the tufts which are becoming decayed.

N.W. Lowlands.—*Lanark:* Lousiewood Law, Elvanfoot, 1900 ft. alt., among *Sphagnum*, per., June 1906 (Macv.).

CEPHALOZIELLA (Spruce) Schiffn.

Cephaloziella Starkii (*Nees*) *Schiffn.*

C. byssacea (Roth.) Warnst.

Generally distributed from Dumfries to Shetland, but uncommon in some districts. It is uncommon over the greater part of the West Lowlands, and is rather rare in the East Lowlands. Is rather common over the Highlands generally, though rare locally. A large number of specimens were examined when this plant and *C. trivialis* were mostly treated as the aggregate *C. divaricata* (Sm.), so that comparatively few localities are given for the segregates: but since then it is evident that the present species is much the commoner of the two, and it is no doubt considerably more common than the number of localities given would suggest. The East Lowlands and part of the West Lowlands must be excepted, as it is certainly uncommon in these districts. It also seems to be uncommon in the Hebrides, being undoubtedly so in those parts of Mull and Skye which have been examined. Although it is rather common in West Inverness, it is probably more common in Mid Perth and the East Highlands in general. It is uncommon on the hills, but ascends to 3900 ft. alt. in Mid Perth. This species is found on dry banks, sides of drains, and damp peaty banks, sometimes on boulders, old walls, and rocks, and creeping over *Frull. Tamarisci.* It forms nearly black thin layers in dry situations, though green in moist places. Plants are most commonly sterile, though perianths are rather common. Fruit, which is mature from July to October, is uncommon. Gemmæ are common.

S.W. Lowlands.—*Dumfries:* Archbank, Moffat, cfr. (Miss Macv.). *Kirkcudbright:* New Galloway, per. (M'And.);

Ben-y-guinea (M'And.); Garroch Wood (M'And.); Creetown (Macv.). *Wigtown:* Nr. New Luce (Ewing).

N.W. Lowlands.—*Ayr:* Auchenleck (Ewing); Afton Water (Macv.). *Lanark:* Hamilton (J. Murr.); Wilsontown (Ewing); Elvanfoot, u. (Macv.): Leadhills, per. (Macv.).

E. Lowlands.—*Peebles:* Rachan, on wall, per. (Macv.); Dreva (Macv.). *Selkirk:* Galashiels (Macv.). *Roxburgh:* Summit of Eildon Hill (Macv.). *Berwick:* Kelphope Glen (Evans). *Haddington:* Dunglass (M'And.); Traprain Law (M'And.). *Edinburgh:* Corstorphine Hill, cfr. (Evans); do. (M'And); nr. Granton, per. (M'And.). *Linlithgow:* Craigiehill Wood (M'And.).

S.E. Highlands.—*Fife and Kinross:* Cullalo (Evans). *S. Perth:* Menstrie Glen (Croall); Strathyre (Hunter). *Mid Perth:* Creag Mhor, cfr. (Ewing); Tyndrum (Macv.); Killin district, f. ascending to 3900 ft. alt. (Macv.). *N. Perth:* King's Seat (Ferg.).

Mid E. Highlands.—*Forfar:* Fern, per. (Ferg.). *Kincardine:* Tillylair (Sim); Invery (Sim); Gateside (Sim); Stonehaven (M'And.). *S. Aberdeen:* Glen Muick, per., 1876 (Sim); nr. Ballater (M. B. Slater).

N.E. Highlands.—*Elgin:* Dreggie Burn (Miss Macv.). *E. Inverness:* Loch Vaa, per. (Miss Macv.); above Kinveachy, Aviemore (Miss Macv.).

W. Highlands.—*Kintyre:* Tarbert (Ewing). *Clyde Isles:* Loch Ranza (Macv.). *Dumbarton:* Nr. Arrochar, on wall (Macv.). *W. Stirling:* Inversnaid (Macv.). *Argyll:* Kentallen, on rock (Macv.); Glencoe (Macv.); Ben Fhada, Glencoe (West); Ben Doureann (H. H. Knight); Glen Ure, Benderloch (Kenn.). *W. Inverness:* Moidart, r.c. (Macv.); Glen Nevis and Coire Dheirg (Macv.); Spean Bridge (Miss Macv.).

Inner Hebrides.—*N. Inner Hebrides:* Ben Cailleach, Broadford (Macv.).

Outer Hebrides.—Tarbert (West).

Lower N. Highlands.—*W. Ross:* Strathcarron (Macv.). *E. Ross:* Loch Luichart, per. (West); Achnasheen, f. (Macv.).

Upper N. Highlands.—*E. Sutherland:* Nr. Brora (Lillie). *W. Sutherland:* Farr (Lillie). *Caithness:* Dirlot (Lillie).

Shetland.—Yell (Sim); Unst (Sim); Fair Isle (Miss Skene); Whalsey (Lillie).

Cephaloziella trivialis *Schiffn.*

C. bifida auct. mult.

Widely distributed from Dumfries to Shetland, but rather rare. The distribution of this segregate is not well known yet, and it is only definitely given for a few localities. Comparatively few specimens have been seen from any part of the country since the separation of this species from *C. Starkii*. It occurs in similar places to the preceding, but generally prefers rather moister situations, and it has not been found on dry boulders. It is also found among *Sphagnum* and on stumps, and it is rare on the hills. Fruit, which is mature from March to October, is common. Gemmæ are common.

Douin states that *C. bifida* (Schreb.), which is monoicous, as is the present plant, is another species; also that *C. Curnowii* is a form or variety of *C. trivialis*.

S.W. Lowlands.—*Dumfries:* Archbank, Moffat, cfr. (Miss Macv.); Crawick Water, cfr. (Macv.). *Wigtown:* Knowe, cfr. (Ewing); nr. New Luce, cfr. (Ewing).

N.W. Lowlands.—*Renfrew:* Loch Thom, on *Sphagnum*, per. (Ewing).

E. Lowlands.—*Peebles:* Moss south of Leadburn, cfr. (Evans). *Selkirk:* Nr. St Mary's Loch, cfr. (Evans); Glenkinnon Burn, cfr. (Macv.). *Haddington:* Nr. Tantallon Castle, per. (M'And.). *Edinburgh:* Corstorphine (M'And.). *Linlithgow:* Drumshoreland Moss, Broxburn, per. (M'And.).

S.E. Highlands.—*Fife and Kinross:* Orrock Hill, per. (Young). *Mid Perth:* Craig-an-Lochain, Killin, alt. 1900 ft., cfr. (Macv.); Craig Chailleach, alt. 2900 ft., per. (Macv.).

Mid E. Highlands.—*Forfar:* Lunan Bay, per. (Ferg.); Auchphersie Burn, cfr. (Ferg.). *Kincardine:* Den of Garol (Sim).

N.E. Highlands.—*E. Inverness:* Moss of Kelly, Inverness, cfr., 1846 (Croall); Carn Dearg, Aviemore, per. (Macv.); Laggantigown nr. Aviemore, cfr. (Miss Macv.).

W. Highlands.—*W. Inverness:* Moidart, cfr. (Macv.).

Outer Hebrides.—Nr. Tarbert, Harris, per. (West).

Lower N. Highlands.—*E. Ross:* Nr. Fortrose, per. (Miss Macv.).

Upper N. Highlands.—*E. Sutherland:* Between Rogart and Lairg, cfr. (Lillie). *Caithness:* Nr. Lister, cfr. (Lillie); Badyrie, per. (Lillie); Moss Head (Lillie); Southhall, Watten (Lillie).

Shetland.—Yell, per., 1878 (Sim); Scalloway, cfr. (West).

Cephaloziella stellulifera (*Tayl.*) *Schiffn.*

This paroicous species is rare, and is known at present only from four districts. It is confined to the low ground and is found on loamy banks. Douin gives the name *C. gracillima* v. *viridis* to our plant, and states that *C. Limprichtii* Warnst. cannot be separated from it.

N.W. Lowlands.—*Lanark:* Kirk Burn, Tinto, on side of footpath in field, cfr., as *C. Limprichtii*, 1906 (Macv.).

E. Lowlands.—*Roxburgh:* Melrose (Macv.); Eildon Hill, Melrose, alt. 800 ft., cfr. (Macv.).

W. Highlands.—*W. Inverness:* Moidart, 1900, per. (Macv.).

Inner Hebrides.—*Mid Inner Hebrides:* Tobermory, on bank at the Battery (Macv.).

Cephaloziella myriantha (*Lindb.*) *Schiffn.*

Cephalozia Jackii Limpr.

Has only been found in a few localities from Dumfries to North Perth, and in Orkney. Although doubtless rare, it has been confused with the other species of the genus, and its distribution is not well known. It occurs usually on loamy banks, and is confined to the low ground, but generally in the subalpine region.

Fruit is common, and is mature from March to August.

S.W. Lowlands.—*Dumfries:* Archbank, Moffat, cfr. (Miss Macv.). *Wigtown:* W. of Luce, above New Luce, cfr., with *Scap. curta* (Ewing).

E. Lowlands.—*Roxburgh:* Eildon Hill, alt. 1000 ft., cfr. (Macv.).

S.E. Highlands.—*Fife and Kinross:* Old wood nr. Cullalo Reservoir, cfr., 1903 (Evans). *N. Perth:* Glen Beg, Glen Shee, per., among moss (Ew. and Young).

Orkney.—Nr. Stromness (Lillie).

ODONTOSCHISMA Dum.

Odontoschisma Macounii (*Aust.*) *Underw.*

Sphagnoecetis communis v. *tessellata* Berggr.

This very rare species has only been found in one locality, on soil-covered rocks at an altitude of about 3000 ft.

S.E. Highlands.—*Mid Perth:* Ben Heasgarnich, 1900 (Ewing); do., 1903 (Young).

Odontoschisma denudatum (*Nees*) *Dum.*

Widely distributed from Dumfries to Shetland, but rather uncommon. Is rare in general in the West Lowlands, though occasionally occurring in quantity on moors; is very rare, if present, in the Upper Clyde valley. It is rare in the East Lowlands and in Fife, and has only been found in a few localities in the East Highlands. Is frequent in West Inverness, where it is found on many low-lying moors, and is also frequent in the extreme north of the mainland of the North Highlands. It does not appear to be very rare in Orkney, but has only been found in one place in Shetland. Its distribution is in a great measure dependent on the presence of peaty moors, as its usual habitat is bare moist peat. It much less frequently is found on stumps and decaying logs in shady places, though often in quantity when it does occur.

The typical plant is a low-ground species and is rarely, if ever, found above 1000 ft. alt. In marshy ground, usually when up the hills to a considerable distance, the plant is represented as the var. *elongatum* Lindl.: this variety is rare.

Fruit has not been seen. Gemmæ are abundant.

S.W. Lowlands. — *Dumfries:* Sanquhar Moor, R.C. (Macv.). *Kirkcudbright:* Barnfoot Hill, on soil (M'And.);

Glenlee Glen, on old wood (M'And.); Glen Trool, peat-moss (Macv.). *Wigtown:* New Luce (M'And.); Knowe (Ewing); Castle Kennedy, stump (Macv.).

E. Lowlands.—*Peebles:* Nr. Leadburn, on peat (Evans). *Berwick:* Nr. Seenes Law, on peat (Evans). *Edinburgh:* Balerno Moss, on peat (M'And.). *Linlithgow:* Fauldhouse Moor, on peat (Evans).

S.E. Highlands.—*Fife and Kinross:* Lomond Hills, on soil, 1883 (Ewing). *S. Perth:* Blair Drummond (Evans). *Mid Perth:* Ben Lawers, 1875 (Whitehead); Achrioch Wood, v.c. on stumps (Macv.); Meal Ghaordie (Ewing).

W. Highlands.—*Argyll:* Glencoe, stump (Macv.); Ben an Dothaidh (Ewing and Macv.). *W. Inverness:* Glenfinnan (Carr. *cf.* Pears. Hep. Brit., p. 175); Moidart, f., usually on peat, occasionally on stumps (Macv.); Ardnamurchan, stump (Macv.); Ben Nevis (Macv.).

Inner Hebrides.—*Mid Inner Hebrides:* Loch Frisa, on peat (Macv.).

Upper N. Highlands.—*E. Sutherland:* Strath Ullie, on peat (Lillie); nr. Rimisdale, on peat (Lillie). *Caithness:* Lybster Well (Lillie); Watten, on peat (Lillie); Badlipster, on turf (Lillie); Scouthill, on peat (Lillie).

Orkney.—Stromness, on peat (West); Kirkwall (West).

Shetland.—Scalloway (West).

var. elongatum *Lindb.*

S.E. Highlands.—*Mid Perth:* Coire Ardran, in marshy ground, alt. 2200 ft. (Macv.); Ben Laoigh (Macv.).

W. Highlands.—*Dumbarton:* Arrochar, Manse Glebe, alt. *ca.* 150 ft. (Macv.).

Orkney.—Stromness (West).

Odontoschisma Sphagni (*Dicks.*) *Dum.*

Generally distributed on low-lying peat-mosses from Dumfries to Shetland. There are comparatively few suitable places for it in the Lowlands, but it is often common where such do occur, and is sometimes abundant. In the East Highlands it appears to be uncommon even where there are peat-mosses. It is common in the West Highlands and Inner Hebrides, also in West Ross and the extreme

north. It has been found in several places in Shetland, though, as in Orkney, cultivation has largely taken the place of peat-moors.

This is a low-ground species, rarely ascending above the lower slopes of the hills at 1200 ft. alt., but has been found to 1900 ft. alt. in the Highlands. It forms small brown tufts, or occurs as scattered stems, creeping over or among *Sphagnum*, in moist but not very wet places in peat-mosses. Fruit is very rare; has been found mature in May and June.

S.W. Lowlands.—*Dumfries:* Solway Moss (Scott); Archbank, Moffat (Miss Macv.); Sanquhar Moor, v.c. (Macv.). *Kirkcudbright:* Terregles Moss, 1840 (Croall); do., 1846 (Cruicks.); New Galloway (M'And.); Glen Trool (Macv.). *Wigtown:* Craigock Park Moor (M'And.); Knowe (Ewing); nr. New Luce (Ewing).

N.W. Lowlands.—*Ayr:* Barskimming Moor (Scott). *Renfrew:* Loch Thom (Ewing and West). *Lanark:* Elvanfoot peat-mosses, v.c. (Macv.); Kirk Burn, Tinto (Macv.).

E. Lowlands.—*Peebles:* Moor nr. Leadburn (Evans); Talla Water, alt. 1400 ft. (Macv.). *Selkirk:* Nr. Tushielaw (Evans). *Berwick:* Nr. Seenes Law (Evans). *Edinburgh:* Pentland Hills (Grev.); nr. Harperrig Reservoir (Evans); Balerno Moss (M'And.); Auchencorth Moss (Evans); Baads (Ewing). *Linlithgow:* Fauldhouse Moor (Evans).

S.E. Highlands.—*Fife and Kinross:* Newburgh (D. Don *cf.* Hook. Fl. Scot., p. 112); Glassmount Marshes (Grev. *cf.* Fl. Edin., p. 273); Lomond Hills (Ewing); Moss Morran (Young). *E. Stirling:* Flanders Moss (Croall); Ridgehead Moss (Evans). *S. Perth:* Aberfoyle, cfr. (Evans); Trossachs (Ewing); Blair Drummond (Evans). *Mid Perth:* Ben Dubh Craige, alt. 1200 ft., r. (Macv.); Achrioch Wood, c. (Macv.). *N. Perth:* Ben Gulabin (Ewing and Young).

Mid E. Highlands.—*Forfar:* Nr. Forfar (D. Don *cf.* Hook. Fl. Scot., p. 112); Guthrie Woods (Sadler Herb.). *Kincardine:* Kerloch (Sim); Dalfro (Sim); Tillylair (Sim). *S. Aberdeen:* Glen Beg, Braemar (Stabl.). *N. Aberdeen:* Mormond Hill (Ewing).

N.E. Highlands.—*E. Inverness:* Nr. Carr Bridge (Miss Macv.).

W. Highlands.—*Clyde Isles:* Nr. Loch Ranza, peat-moss, v.c. (Macv.). *Argyll:* Ben Cruachan (Croall); do., f. from 300–500 ft. (Macv.); Ben Udlaidh, alt. 1900 ft. (Macv.); Loch Tulla (Macv.); Ben an Dothaidh (Ewing and Macv.); Glen Lochy (Macv.); Dunoon (Ewing). *W. Inverness:* Moidart, c., cfr. v.r. (Macv.); Ardnamurchan, c. (Macv.); Sunart, c. (Macv.); Ben Nevis (Macv.); Loch Morar (West).

Inner Hebrides.—*S. Inner Hebrides:* Sgor Bhogachain, Islay, alt. 1000 ft. (Gilm.); Machrie, Islay (Miss Evans). *Mid Inner Hebrides:* Tiree, among *Campylopus* (Macv.); Loch Frisa (Macv.). *N. Inner Hebrides:* Peat-moss nr. Broadford, r.c. (Macv.).

Outer Hebrides. — Clisham (West); Tarbert, many places (West); Balallan (West).

Lower N. Highlands. — *W. Ross:* Kyle (Macv.); Strathcarron Moss, v.c. (Macv.). *E. Ross:* Achnasheen, r. (Macv.); Loch Rosque (West); Loch Luichart, r. (West).

Upper N. Highlands.—*E. Sutherland:* Strath Ullie (Lillie). *W. Sutherland:* Forsinard (Lillie); Ben Clibreck (Lillie). *Caithness:* Several localities, as nr. Badyrie, nr. Wick, East Watten Moss, Kirk Moss, and Ben Rhea (Lillie).

Orkney.—Stromness (West).

Shetland. — Lerwick (Sim); Whiteness (Sim); Yell (Sim); Unst (Sim).

ADELANTHUS Mitt.

Adelanthus decipiens (*Hook.*) *Mitt.*

Very rare, and confined to the west coast from Arran to West Inverness. In the latter district it is rather common in ravines and other shady places, occurring as large compact patches of a dark-green colour, becoming nearly black in dry weather. It is most commonly found on moist rocks, less frequently on trees. None of its localities are more than a mile from the sea. The male plant is very common; the female has not been seen.

West Highlands.—*Clyde Isles:* Loch Ranza, at head of village, among rocks, v.r. (Macv.). *Dumbarton:* Arrochar Wood, on banks in three places, 1903 (Macv.). *Argyll:*

Nr. Ballachulish Pier, on bank (Macv.). *W. Inverness:* Moidart, f., 1898 (Macv.); Salen Burn, Ardnamurchan (Macv.); Resipol Burn, f. (Macv.).

CALYPOGEIA Raddi

Calypogeia Trichomanis (*L.*) *Corda*

Kantia Trichomanis (L.) Gray

Generally distributed and frequent from Dumfries to Shetland. Is frequent in many parts of the Lowlands, especially in the Southern Uplands above 1200 ft. alt.; in some districts of the Lowlands it is rare on the low ground. It is common in the East Highlands on the low ground and frequent on the hills, ascending to 3000 ft. alt. in Mid Perth. Is rather common in the West Highlands, where it has been found to 2500 ft. alt., and is common in the Hebrides. It is also common in the North Highlands, and is at least frequent in Orkney and Shetland. The comparative frequency of this species and *C. fissa* is difficult to state. In some districts one species is more common, and in another not far removed the other is the more common. In general it may be said that *C. fissa* is the more common in the south-west and west counties and Hebrides, while *C. Trichomanis* is the more common in the centre, east, and north of the country and in Shetland. On the hills the latter species is much the commoner and ascends to a higher altitude. *C. fissa* is uncommon on the hills, and has not been found above 2300 ft. alt. This species grows on loamy and peaty banks, stumps, in flat pale-green patches, and as scattered stems among *Sphagnum*. Is found on limestone as well as other rocks. Fruit, mature from April to June, is frequent. Gemmæ are often abundant.

S.W. Lowlands.—*Dumfries:* Crichope Linn (Scott); Penton Linn (Scott); Moffat (M'And.); Crawick Water, on rotten log (Macv.) *Kirkcudbright:* New Galloway (M'And.); Glen Trool (Macv.); Loch Skerrow (G. West). *Wigtown:* Knowe, cfr. (Ewing); nr. New Luce (Ewing).

N.W. Lowlands.—*Ayr:* Barskimming Moor, and by river Ayr (Scott). *Renfrew:* Scotstownhill (Campb.); Loch Thom (Ewing). *Lanark:* Hamilton (J. Murr.); Carstairs Moss, c. (Macv.); Tinto (Macv.); Elvanfoot (Macv.); Lowther Hills, f. to 1900 ft. alt. (Macv.).

E. Lowlands.—*Peebles:* Cowie's Linn (Evans); Carton Burn, c. from 1000–1300 ft. (Macv.); Logan Water, c. at 1200 ft. alt. (Macv.); Tweedsmuir (Macv.). *Selkirk:* Nr. Tushielaw (Evans). *Roxburgh:* Melrose district, r. (Macv.). *Berwick:* Nr. Seenes Law (Evans). *Haddington:* Lammer Law (Evans). *Edinburgh:* Balerno Moss, f. (Macv.); Roslin Glen (A. Murr.); Redford Wood (A. Murr.); Bonally Hill (Evans); Baads (Ewing). *Linlithgow:* Drumshoreland (Evans); Fauldhouse Moor (Evans); nr. Bathgate (Evans); Crawhill (Evans).

S.E. Highlands.—*Fife and Kinross:* Lomond Hills (Young); Begg Wood, several places (Young); Cullalo (Evans); Dysart (Young); Isle of May (Evans). *E. Stirling:* Earl's Burn Reservoir (K. & S.); Muiravonside House (Evans); Ridgehead Moss (Evans). *S. Perth:* Loss Hill (K. & S.); Aberfoyle (Evans); Trossachs, several places (Ewing); Strathyre (Macv.). *Mid Perth:* Killin district, c., ascending to 3000 ft. on Ben Lawers (Macv.); Ben Dubh Craige, f. (Macv.); Ben Laoigh, r.c. (Macv.); Achroich Wood, f. on stumps (Macv.); nr. Inver (M'In.). *N. Perth:* Glen Tilt (Ferg.); Meal Vain, Glen Shee (Ferg.); Glen Beg, Glen Shee (Ferg.); Ben Gulabin, f. (Ew. and Young).

Mid E. Highlands.—*Forfar:* Clova Mountains, 1824 (Grev.); Glen Dole, 1843 (Gard.); foot of Glenesk (Croall); Nathro (Ferg.); Fern (Ferg.). *Kincardine:* Scolty (Sim); Kerloch (Sim). *S. Aberdeen:* Ben MacDhui (Stabl.); Lochnagar (Stabl.); Glen Beg, Braemar (Stabl.); Lion's Face and other places, Braemar (Stabl.); Balmoral (Michie). *N. Aberdeen:* Mormond Hill (Ewing).

N.E. Highlands.—*Elgin:* Lochan Dorb (Miss Macv.). *E. Inverness:* Glen Feshie (Barker); Carn Dearg, Aviemore (Macv.); Laggantigown (Miss Macv.); Carr Bridge (Miss Macv.); Glenferness (Miss Macv.).

W. Highlands.—*Kintyre:* Ronachan (Macrae); Clachan (Macrae); Tarbert (Ewing). *Clyde Isles:* Bute (Ewing); Loch Ranza, c. (Macv.). *Dumbarton:* Craigmaddie

(Campb.); Ardlui (Macv.); Arrochar (Macv.); Loch Humphrey (Ewing). *W. Stirling:* Nr. Rowardennan (K. & S.); Inversnaid (Macv.). *Argyll:* Kilmun (Wilkie); Puck's Glen (A. Murr.); Oban (Ewing); Glencoe, alt. 1000 ft. (Macv.); head of Loch Awe, c. (Macv.); Ben Cruachan, to alt. 1900 ft. (Macv.); Ben Udlaidh, alt. 1900 ft. (Macv.); Loch Tulla (Macv.); Ben Doureann, c. (Macv.); Ben Arthur, alt. 2000–2500 ft. (Macv.). *W. Inverness:* Choir Arder (Ferg.); Spean Bridge (Miss Macv.); Ben Nevis (Macv.); Glen Nevis, alt. 1900 ft. (Macv.); Moidart, c. (Macv.); Ardnamurchan, c. (Macv.); Sunart, c. (Macv.); Loch Morar (West); Mallaig (West).

Inner Hebrides.—*S. Inner Hebrides.*—Jura (Ewing); Sgor Bhogachain, Islay, alt. 1000 ft. (Gilm.); Cairnmore Wood and Ardbeg, Islay (Gilm.). *Mid Inner Hebrides:* Dervaig (Macv.); Allt na Searmoin, c. (Kenn.). *N. Inner Hebrides:* Broadford district, r.c. (Macv.); Sligachan (Miss Macv.).

Outer Hebrides.—Barra (Ewing); Stornoway, cfr. (Gibs.); Tarbert (West); Balallan (West).

Lower N. Highlands.—*W. Ross:* Kyle (Macv.); Strome Ferry (Macv.); Strathcarron, c. to 2200 ft. alt. (Macv.); Loch Maree, cfr. (Miss Macv.); Gairloch (Miss Macv.). *E. Ross:* Achnasheen (Macv.); Loch Luichart (West).

Upper N. Highlands.—*E. Sutherland:* The Ord nr. Helmsdale (Lillie); nr. Rogart (Lillie). *W. Sutherland:* Strath Halladale (Lillie); Ben Clibreck (Lillie); Hope Bridge (Lillie). *Caithness:* Several localities, as North Bilbster, Kellunster, Watten, Ousdale, and West Dunnet Hill (Lillie).

Orkney.—Eday (Lillie); Kirkwall (West); Hoy, several places (Lillie).

Shetland.—Nr. Lerwick (Sim); Yell (Sim); Unst (Sim); Uni Firth, several places (Grieve); Clousta (Grieve); Bressay (West); Loch of Girlsta, Nesting (Beeby); Weisdale (Beeby).

var. Neesiana *Massal. et Carest.*

Inner Hebrides.—*Mid Inner Hebrides:* Loch Mishnish (Macv.).

Calypogeia fissa (*L.*) *Raddi*

Kantia Sprengelii Pears.

The general distribution of this species is given under *C. Trichomanis*. In the Upper Clyde district it is mostly this species which occurs on the low ground, while above 1200 ft. alt. it is *C. Trichomanis*. It is also much more common in the low ground of the Upper Tweed valley. In the island of Mull it is much more common than *Trichomanis*, being the usual plant of banks, while the latter mostly occurs on peat-mosses.

It is found on the same kind of stations as *C. Trichomanis*, including decaying logs. Fruit is more common than in the latter species, and is mature at the same time. Gemmæ are often abundant.

S.W. Lowlands.—*Dumfries:* Moffat (Johns.); Drumlanrig (J. Murr.); Sanquhar district, f. (Macv.). *Kirkcudbright:* Nr. Knockmarling (M'And.); Kippford (Ham.); Glen Trool, f. (Macv.). *Wigtown:* Knowe (Ewing); Glenluce (Macv.).

N.E. Lowlands.—*Ayr:* Fairlie (Ewing); Glen Afton, c. (Macv.). *Renfrew:* Gourock (Ewing); Loch Thom (Ewing); Glen, Misty Law (Scott). *Lanark:* Kirk Burn, Tinto (Macv.); Elvanfoot district, f. (Macv.).

E. Lowlands.—*Peebles:* Cowie's Linn (Evans); Rachan, r. (Macv.); Carton Burn, alt. 900 ft., v. (Macv.). *Selkirk:* Tushielaw (Evans); Glenkinnon Burn, v. (Macv.); Lindean, c. (Macv.); Galashiels, f. (Macv.). *Roxburgh:* Fernieherst (Miss Macv.); Melrose district, f. (Macv.). *Berwick:* Pease Dean (Macv.); Cockburnspath (M'And.). *Haddington:* Dunglass Burn, several places (Evans). *Edinburgh:* Balerno Moss (Macv.); Redford Wood (A. Murr.); Dalmahoy Hill, cfr. (A. Murr.); Allermuir Glen (Evans); Bilston Glen (Evans). *Linlithgow:* Carriber Glen, several places (Evans); Drumshoreland (Evans); Dalmeny (Evans).

S.E. Highlands. — *Fife and Kinross:* Burntisland (Young); Pouring Den (Young); Moss Morran (Young); Lomond Hills (Evans); St Andrews (Macv.). *E. Stirling:* Wester Glen (K. & S.); Muiravonside (Evans). *S. Perth:* Strathyre c. (Macv.); Trossachs (Ewing). *Mid Perth:*

Killin district. F. (Macv.); Lochan-na-Lairige, alt. 1500 ft. (Macv.); Ben Laoigh, alt. 2300 ft. (Macv.); Achrioch Wood (Macv.); Lamberkin, nr. Perth (Meld.). *N. Perth:* Dunkeld (M'In.); Glen Beg, Glen Shee (Ewing and Young).

Mid E. Highlands. — *Forfar:* Den of Airlie, 1862 (Croall); Auchphersie (Ferg.); Reeky Linn (Aimer). *Kincardine:* Invery (Sim); Linn of Dye (Sim). *S. Aberdeen:* Birse Hill (Sim); Ballochbuie Forest (Stabl.). *N. Aberdeen:* Turriff (Lillie).

N.E. Highlands.—*Elgin:* Glen Beg nr. Grantown (Miss Macv.). *E. Inverness:* Nethy Bridge (Miss Macv.); Carr Bridge (Miss Macv.); Slochd (Miss Macv.); Boat of Garten (Miss Macv.).

W. Highlands.—*Clyde Isles:* Bute (Ewing); Loch Ranza (Campb.). *Dumbarton:* Helensburgh (Ewing); Arrochar, F. (Macv.); nr. Allt Dubh Uisgue (Macv.); Tarbert (Macv.). *W. Stirling:* Campsie (Ewing). *Argyll:* Benmore (A. Murr.); Sandbank (Ewing); head of Loch Awe, C. (Macv.); Ben Cruachan, alt. 1700 ft. (Macv.); Oban (Ewing). *W. Inverness:* Moidart, C. (Macv.); Ardnamurchan, C. (Macv.); Sunart, C. (Macv.); Glen Nevis (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Ardimersay, Islay (Gilm.). *Mid Inner Hebrides:* Tiree (Macv.); nr. Tobermory (Kenn.); C. in N. of Mull (Macv.). *N. Inner Hebrides:* Broadford district, R.C., and Ben Cailleach, at 1500 ft. alt. (Macv.); Sligachan (Miss Macv.); Portree (Ewing).

Outer Hebrides.—Barra (Ewing); Benbecula (Ewing); Tarbert (West); Balallan (West).

Lower N. Highlands.—*W. Ross:* Strome Ferry (Macv.); Strathcarron, R.C. (Macv.); Loch Maree (Miss Macv.). *E. Ross:* Achnasheen (Macv.); Loch Luichart (West).

Upper N. Highlands.—*E. Sutherland:* Strath Ullie (Lillie); Ben Griam Mohr (Lillie); nr. Ben Roscie (Lillie); nr. Garvalt (Lillie). *E. Sutherland:* Strath Halladale (Lillie); Ben Clibreck (Lillie). *Caithness:* Old Hall, Watten (Lillie); Ousdale (Lillie); Dorrery (Lillie).

Orkney. — Hoy (West); Finstown (West); Kirkwall (West).

Shetland.—Burn of Vallor, 1878 (Sim); Gelli Gill, nr. Hillswick (Beeby); Scalloway (West).

CALYPOGEIA SPHAGNICOLA (*Arn. et Persson*) *Warnst. et Loeske*

Kantia sphagnicola Arn. et Persson

Found at present in only one locality in the East Highlands. Somewhat similar plants have been seen from other districts, but in too small quantity for accurate identification.

N.E. HIGHLANDS.—*E. Inverness:* Peat-moss nr. Carr Bridge, 1904 (Miss Macv.).

CALYPOGEIA SUECICA (*Arn. et Persson*) *C. Müll. Frib.*

Kantia suecica Arn. et Persson

This rare species has only been found in one ravine in the West Highlands.

W. HIGHLANDS. — *W. Inverness:* Resipol, Sunart, on decaying log in ravine, with *Nowellia curvifolia*, 7th Aug. 1899 (Macv.).

CALYPOGEIA ARGUTA *Nees et Mont.*

Kantia arguta (Nees et Mont.) Lindb.

Widely distributed from Dumfries to Shetland, but rare except on the west side of the country. It is uncommon in the West Lowlands, and very rare in the Upper Clyde district. Is rare in the East Lowlands and very rare in the Upper Tweed valley. It has not been yet found in Fife or in any part of the East Highlands with the exception of Strathspey. In the West Highlands and Hebrides it is frequent. It has been found in a few places in the North Highlands, but is very rare in Caithness. It also appears to be rare in Orkney and Shetland. This species is confined to the low ground, and is found in greatest quantity near the shore of the west coast. It forms thin, very pale green patches on loamy banks and sides of ditches, frequently accompanied by *C. fissa*. It has only been found sterile. Gemmæ are common.

S.W. LOWLANDS.—*Dumfries:* Drumlanrig, 1894 (J. Murr.); Crawick Water, R. (Macv.). *Wigtown:* Nr. New Luce (Ewing); Glen Luce (Macv.); Dunsky, roadside ditch, v.c., and Dunsky Glen (Macv.).

N.W. Lowlands.—*Ayr:* Ladyland (Miss Macv.). *Renfrew:* Loch Thom (Ewing). *Lanark:* Kirk Burn, Tinto, alt. *ca.* 950 ft. (Macv.).

E. Lowlands.—Nr. Broughton, on bank, v.r. (Macv.). *Selkirk:* Philiphaugh (Evans). *Haddington:* Ormiston Hall Woods, with *Scapania curta* (Evans); Dunglass Woods, with *Haplozia gracillima* (Evans). *Edinburgh:* Bilston Glen, on wet sandstone rocks (Evans). *Linlithgow:* Riccarton Hill, on clay soil with *Dicranella* (Evans).

N.E. Highlands.—*E. Inverness:* Nethy Bridge, ditch side (Miss Macv.).

W. Highlands.—*Clyde Isles:* Brodick (Campb.); Corrie, Arran (Ewing); Loch Ranza, r. (Macv.); Bute (Ewing). *Dumbarton:* Helensburgh (Dr Graham *cf.* Pears. Hep. Brit., p. 140); Arrochar (Macv.). *W. Stirling:* Inversnaid, f. (Macv.). *Argyll:* Nr. Loch Awe Station (Macv.). *W. Inverness:* Moidart, f. (Macv.); Ardnamurchan (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Ardimersay, Islay (Gilm.). *Mid Inner Hebrides:* Tobermory, u. (Macv.); Allt na Searmoin (Kenn.). *N. Inner Hebrides:* Mill Burn, Broadford (Macv.); Sligachan (Miss Macv.).

Outer Hebrides.—Stornoway (Gibs.); Tarbert (West); Balallan (West).

Lower N. Highlands.—*W. Ross:* Strathcarron, u. (Macv.); Gairloch (Miss Macv.); Loch Maree (Miss Macv.). *E. Ross:* Achnasheen (Macv.); Loch Luichart (West).

Upper N. Highlands.—*W. Sutherland:* Strath Halladale (Lillie); Strath Naver (Lillie). *Caithness:* Dunbeath (Lillie).

Orkney.—Finstown, on decaying wood (West); Hoy (Lillie).

Shetland.—Gelli Gill, nr. Hillswick (Beeby).

BAZZANIA S. F. Gray

Mastigobryum Nees

Bazzania trilobata (*L.*) *Gray*

Widely distributed from Dumfries to Aberdeen and West Ross, but uncommon. It is rare in the West Lowlands and has not been found in the East Lowlands. Is very rare in Fife and towards the coast of the East Highlands; it has

been found in several of the more sheltered parts of the inland districts of this province, but is uncommon. Is generally distributed in the West Highlands, being rather common in some districts, though in others rare. Is very rare in the Inner Hebrides, and has not been found in the Outer Hebrides. Is uncommon in West Ross. It appears to be absent from the extreme north of the mainland and from Orkney and Shetland.

It is only found in well-sheltered places on the low ground, and forms compact yellow-green cushions or tufts on moist rocky banks in shade, or among old heather. Sterile female plants are very common; male plants are rare. Fruit has not been seen.

S.W. Lowlands.—*Dumfries:* Crichope Linn, v.r. (Macv.). *Kirkcudbright:* Glenlee Glen (M'And.); Earlston Wood, Dalry (Scott). *Wigtown:* W. of Luce, above New Luce (Ewing).

S.E. Highlands.—*Fife and Kinross:* Dunearn Hill (Grev. *cf.* Fl. Edin., p. 277); nr. Newburgh on Tay (How.); Humbie Wood, Aberdour (M'And.). *E. Stirling:* Boquhan Burn (K. & S.). *S. Perth:* Strathyre (Macv.); Trossachs (Ewing and West). *Mid Perth:* Finlarig Wood, r. (Macv.); Inver Wood (M'In.); Braan, Inver (M'In.). *N. Perth:* Dunkeld (M'In.).

Mid E. Highlands.—*Forfar:* Glenogil (Ferg.). *S. Aberdeen:* Hill of Fare (Dickie); Ben na Bourd, 1854 (Croall); Braemar (Croall); Balmoral (Stabl.).

N.E. Highlands.—*E. Inverness:* Craigellachie, Aviemore (Wheldon).

W. Highlands.—Loch Lomond, 1822 (Grev.). *Kintyre:* Ronachan (Macrae); Tarbert (Ewing); between Ardrishaig and Tarbert (Ewing). *Clyde Isles:* Loch Ranza, r. (Macv.). *Dumbarton:* Ravine nr. Ardlui, r. (Macv.); Tarbert (Macv.); Manse Burn, Arrochar, r. (Macv.). *W. Inverness:* Rowardennan (K. & S.); Inversnaid, c. (Macv.). *Argyll:* Lochgoilhead, 1857 (Nich.); Kilmun (Wilkie); Puck's Glen (A. Murr.); Loch Awe district, several places (Macv.); Glen Ure (Kenn.). *W. Inverness:* Moidart, f. (Macv.); Ardnamurchan, f. (Macv.); Sunart, f. (Macv.); Coire Dheirg, Glen Nevis (Macv.); nr. Loch Morar (West).

Inner Hebrides.—*S. Inner Hebrides:* Kildalton Woods, Islay (Ewing).

Lower N. Highlands.—*W. Ross:* Island on Loch Maree (Carr.); Strathcarron, u. (Macv.).

Bazzania tricrenata (*Wahl.*) *Trevis*

Widely distributed from Dumfries to Shetland. It is rare in the West Lowlands, having only been found in two subalpine districts. Is very rare in the East Lowlands, having only been found in one subalpine locality. Has not been found in Fife or near the coast of the East Highlands, but is common in most of the hilly districts of that province. Its apparent absence from North Perth is curious, but one or two other species also appear to miss this district. It has also not yet been found in East Inverness. It is frequent in the Forfar and Aberdeen hills, and very common in Mid Perth, where it ascends to 4000 ft. alt. Is very common in many parts of the West Highlands and Hebrides from sea-level, and is common in the hilly parts of the North Highlands. It is frequent on the Ward Hill, Hoy, Orkney, but is rare in Shetland, there being apparently few suitable localities for it. The plant of the Lowlands, and usually of the low ground in the Highlands, is *B. tricrenata* (Wahl.). This is also the most common form on the hills, though the *B. triangularis* of Pears. *Hep. Brit. Isles* is frequent there, but uncommon on the low ground. In Shetland, the latter only has been seen. Occurs as compact green to reddish-brown tufts on shady rocky banks on the low ground, and on rock ledges and grassy slopes on the hills. Is very frequent in mixture with other species, as *Anast. orcadensis*, and with mosses. The form *triangularis* (in the restricted sense) also grows directly on the rock. In the latter, male inflorescence is plentifully found; in the other, female plants are common.

Ben Lomond, 1822 (Grev.).

S.W. Lowlands.—*Kirkcudbright:* Black Craig, New Galloway (M'And.).

N.W. Lowlands.—*Ayr:* Glen nr. Ladyland, with *Lophozia quinquedentata* (Scott). *Renfrew:* Glen N. of Glenlora, with *Metzgeria hamata* (Scott).

E. Lowlands.—*Peebles:* Talla Linn, alt. 1000 ft. (Macv.).

S.E. Highlands.—*S. Perth:* Strathyre (Macv.); Trossachs, several places (Ewing); *Mid Perth:* Ben Lawers, 1823 (Grev.); do. (Gard.); Killin district, v.c., ascending to 4000 ft. alt. on Ben Lawers (Macv.); Ben Vorlich, summit (Evans); Creag Mhor (Ewing); Ben Heasgarnich (Ewing); Ben Laoigh (Ewing); do., r.c. (Macv.); Ben Dubh Craige, alt. 2200 ft., r. (Macv.); Ben More (Barker); Coire Ardran, c. (Macv.).

Mid E. Highlands.—*Forfar:* Clova, 1857 (Croall); do. (Ferg.); Glenesk (Croall); Camlochan (Ferg.); do., f. (Ewing and Young). *S. Aberdeen:* Ben MacDhui, 1830 (Grev.); do. (Stabl.); Glen Callater (Dickie); Braemar, 1856 (Croall); Lochnagar (Stabl.).

N.E. Highlands.—*Banff:* Nr. Loch Avon, 1830 (Grev.).

W. Highlands.—*Clyde Isles:* Arran, 1843 (Stark); Loch Ranza (Campb.); do., u. (Macv.). *Dumbarton:* Ben Vorlich (Stirton); do., v.c. (Macv.); Arrochar, r.c. (Macv.). *W. Stirling:* Ptarmigan (K. & S.). *Argyll:* Loch Awe side, 1845 (Stark); do., l.c. (Macv.); Coire Ghlais, Ben Cruachan, c. (Macv.); Ben Doureann (Dixon); Glencoe, v.c. (Macv.); Loch Tulla (Macv.); Kentallen (Macv.); Ben Arthur, alt. *ca.* 2300 ft., f. (Macv.); Glen Ure (Kenn.); Benmore, Kilmun, etc. (A. Murr.); Dunoon (Ewing). *W. Inverness:* Glenfinnan (Carr.); Moidart, v.c. (Macv.); Ardnamurchan, v.c. (Macv.); Sunart, v.c. (Macv.); Ben Nevis (Macv.); Coire Dheirg (Macv.); Choir Arder (Barker).

Inner Hebrides.—*S. Inner Hebrides:* Jura (Ewing). *Mid Inner Hebrides:* Aros Falls (Dixon); Allt na Searmoin, c. (Kenn.); Ben More (Kenn.). *N. Inner Hebrides:* Ben Cailleach, Broadford, c. (Macv.).

Outer Hebrides.—Tarbert (West); Harris (Ewing).

Lower N. Highlands.—*W. Ross:* Ben Eay, 1867 (How.); Strathcarron, c. (Macv.); Strome Ferry, v.c. (Macv.); Kyle, c. (Macv.). *E. Ross:* Achnasheen (Macv.); Scuir na Lapaich (Cocks).

Upper N. Highlands.—Sutherland, 1834 (Grev.). *W. Sutherland:* Ben Clibreck (Lillie); Ben Laoghal (Lillie). *Caithness:* Morven (Lillie).

Orkney.—Ward Hill, Cuilags, Segal Burn, and Glen Trowie, Hoy, f. (Lillie).

Shetland.—Björds of Uyea, Northmaven, alt. *ca.* 500 ft., with *Scapania gracilis* (Beeby); Saxa Vord, Unst, with *Blepharostoma trichophyllum* (Lillie).

PLEUROCLADA Spruce

Pleuroclada albescens (*Hook.*) *Spruce*

This alpine species is confined to some of the higher mountains in the Highlands. It has been found in widely separated districts, but is too rare to admit of any special preference for either side of the country, though it appears to be rather more frequent towards the eastern side. It grows on moist soil where snow lingers through part of the summer, and has not been found below 3000 ft. alt. It reaches to about 4300 ft. alt. in Ben Nevis.

The var. *islandica* is rarer than the typical plant, and is found at lower levels, descending to below 2000 ft. alt. in one locality.

S.E. Highlands.—*Mid Perth:* Ben Laoigh, alt. 3700 ft., 1882 (Ewing); Ben Lawers, per., alt. 3400 ft. (Macv.); summit of Cam Craig, Killin (Ewing). *N. Perth:* Ben Gulabin (Ew. and Young).

Mid E. Highlands.—*Forfar:* Clova, 1839 (W. W. Evans); Camlochan, 1904 (Ew. and Young). *S. Aberdeen:* Coire Ceanmor (Ew. and Young); Meal Odhar (Ew. and Young).

N.E. Highlands.—*Banff:* Head of Loch Avon (Croall *cf.* Pears. Hep. Brit., p. 194); above Loch Avon, with *Gymn. obtusum* (Stabl.).

W. Highlands.—*W. Inverness:* Ben Nevis, 1821 (Hook. and Grev.); do., nr. summit, 1875 (Whitehead); do., 1908 (H. H. Knight).

Lower N. Highlands.—*E. Ross:* Scuir na Lapaich (Cocks).

var. islandica *Nees*

Mid E. Highlands.—*Kincardine:* Mount Shade, with *Gymn. obtusum* (Sim). *S. Aberdeen:* Lochnagar, 1876, several gatherings, one being mixed with *Leptocyphus Taylori* (J. and T. Sim).

W. Highlands.—*Clyde Isles:* Goatfell, September 1840 (Adamson in Dickie Herb.).

LEPIDOZIA Dum.

Lepidozia pinnata (*Hook.*) *Dum.*

L. tumidula Tayl.

This Atlantic species is confined to the west coast from Ayr to Shetland. It is very rare in the Lowlands, but is frequent in some parts of the West Highlands, though rare as a whole. In Moidart, West Inverness, it is quite a common species, and is often in abundance close to the shore. It is rare in the Hebrides, North Highlands, and Shetland. It is found in greatest plenty on rocky banks and peat-covered boulders, and about the foot of cliffs along the shores. In such positions it often forms very compact cream-coloured cushions from several inches to a foot or more in diameter. It requires moist but not wet soil, and a shady position, but not necessarily sheltered, the habitats on the shore rocks being often fully exposed to the wind. It also frequently occurs on moist peaty banks in rocky places in coppices which occur on the sides of hills sloping to the sea, but always at low level. Such positions being in more shade than when on the shore, the plant is usually of a light green colour. Male plants are common, more so than the female; perianths are rare; fruit has not been seen. Mature antheridia have been noticed in October.

N.W. Lowlands.—*Ayr:* Big Lees, West Kilbride, 1887 (Ewing).

W. Highlands. — *Kintyre:* Between Ardrishaig and Tarbert, rock nr. sea-shore (Ewing). *Clyde Isles:* Loch Ranza, u. (Macv.); Lamlash (M'And.). *Argyll:* Glen G'umich, Oct. 1846 (R. M. Stark); Puck's Glen, Kilmun (A. Murr.); Kilmun (Scott). *W. Inverness:* Moidart, r.c. (Macv.); do., per., v.r. (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Sgor Bhogachain, Islay, alt. 1000 ft. (Gilm.).

Lower N. Highlands.—*W. Ross:* Loch Maree, 1889 (Carr.).

Shetland.—Yell, 1878 (Sim).

Lepidozia reptans (*L.*) *Dum.*

This species, though one of the most generally distributed from Dumfries to Shetland, is rare or absent in several districts. It is uncommon in the low-lying parts of the West Lowlands, and has not been observed on the lower ground on the Tinto and Elvanfoot or Leadhills districts of the Upper Clyde valley, but it is frequent in some of the other subalpine districts, and ascends to 1900 ft. alt. Its distribution seems greatly dependent on the presence of peat or decaying vegetable matter. It is also uncommon in several parts of the East Lowlands, especially in the Upper Tweed valley. It is frequent throughout the East Highlands, except near the coast, and is common in the West Highlands, but is rather uncommon on the less sheltered Hebrides. Is common in West Ross, and frequent throughout the North Highlands. It appears to be uncommon in Orkney and Shetland, though found in several parts of the latter. The species is rare on the hills, though it has been found to 3200 ft. alt. in Mid Perth. In the West Highlands it has not been found above 1000 ft. alt.

Grows in thin green layers, more rarely in compact cushions, and frequently creeping as scattered stems among other species, on banks, stumps, about the roots of trees, and occasionally on tree stems. Perianths are frequent; and fruit, mature from April to August, is not rare.

S.W. Lowlands.—*Dumfries:* Moffat (M'And.); Crichope Linn (Scott); do., C. (Macv.); Crawick Water, R.C. (Macv.). *Kirkcudbright:* Nr. Routing Bridge, 1840 (Cruicks.); New Galloway (M'And.). *Wigtown:* Lochnaw (Grev. Herb.).

N.W. Lowlands.—*Ayr:* Fairlie (Ewing); river Ayr nr. Mauchline (Scott); Barskimming Moss (Scott); Ladyland (Scott). *Renfrew:* Lochwinnoch (Ewing); Loch Thom (Ewing and West); Cloch (West); Glen, Misty Law (Scott). *Lanark:* Blantyre Priory (Ewing); Cadder (J. Murr.); Fiddler Gill (J. Murr.); Lousiewood Law, F. on peaty banks from 1700–1900 ft. (Macv.).

E. Lowlands. — *Peebles:* Macbiehill (Evans); Cowie's Linn (Evans). *Roxburgh:* Fernieherst (Miss Macv.); Melrose district, r., cfr. (Macv.). *Berwick:* Cockburnspath, several places (M'And.). *Haddington:* Dunglass Woods (Evans). *Edinburgh:* Auchendinny Woods, 1823 (Grev.); Roslin Glen (A. Murr.); Balerno Moss (A. Murr.); Redford Wood (A. Murr.); nr. Thrieplaw Pond (A. Murr.); Harperrig Reservoir (Evans); Nether Habbie's Howe (Evans); Torduff (Evans); Bilston Glen (Evans); Bavelaw Wood (Evans); Caerketton Rocks (Evans); Scald Law (Evans). *Linlithgow:* Nr. Bathgate (Evans); Dalmeny Wood (M'And.); Carriber Glen (M'And.); Crawhill (Evans) Craighall (M'And.).

S.E. Highlands. — *Fife and Kinross:* Lomond Hills (Young); Cullalo (Evans); Glen Queich (Evans); Aberdour (M'And.); Isle of May (Evans). *E. Stirling:* Wester Glen, per. (K. & S.); Muiravonside (Evans). *S. Perth:* Menstrie Glen (K. & S.); Strathyre (Macv.); Aberfoyle, several places (Evans); Trossachs, several places, also cfr. (Ewing). *Mid Perth:* Killin district, f. on the low ground (Macv.); Ben Vorlich summit, alt. 3200 ft. (Evans); Achrioch Wood, r.c. on stumps and trees (Macv.); Am Binnean (Young). *N. Perth:* King's Seat, 1879 (Ferg.); Corsie Hill nr. Perth (Meld.); Dunkeld (M'In.); Ben Gulabin (Ew. and Young).

Mid E. Highlands.—*Forfar:* Foot of Glenesk, 1861 (Croall); Auchphersie (Ferg.); N. of Whinny Neuk (Aimer). *Kincardine:* Dalfro, Inshman Wood, Tillylair, Blackhall, Den of Lathers, Mount Shade (Sim); Stonehaven (M'And.). *S. Aberdeen:* Den of Midmar, cfr., 1840 (Dickie); Hill of Fare, 1840 (Dickie); Braemar (Croall); Finzean (Sim); Fiendallachar Burn (Stabl.); Ballochbuie (Michie); Lochnagar (Stabl.). *N. Aberdeen:* Mormond Hill (Ewing).

N.E. Highlands. — *E. Inverness:* Kilravock Wood, Nairn, cfr., 1846 (Croall); nr. Aviemore (Miss Macv.); Loch Vaa (Miss Macv.); Carr Bridge (Miss Macv.); Glenferness (Miss Macv.).

W. Highlands.—Loch Lomond, 1822 (Grev.). *Kintyre:* Campbeltown, cfr. (Ewing); Ronachan (Macrae); Tarbert (Ewing). *Clyde Isles:* Bute (Ewing); Loch Ranza, c., also cfr. (Macv.). *Dumbarton:* Milngavie (Ewing); Ardlui

(Macv.); Shandon (Miss P. Macv.); Tarbert, c. (Macv.); Garscube (Campb.). *W. Stirling:* Ashdhu Glen, Killearn (K. & S.); Inversnaid (K. & S.). *Argyll:* N. of Crinan Canal (West); Coire Athoich (A. Murr.); Sandbank (Ewing); Oban (Ewing); Glencoe, alt. 1000 ft. (Macv.); head of Loch Awe, r. (Macv.); Ballachulish (Macv.); Loch Tulla, c. (Macv.); Kentallen (Macv.). *W. Inverness:* Moidart, c. (Macv.); Ardnamurchan, c. (Macv.); Sunart, c. (Macv.); Morar (West); Ben Nevis (Macv.); Coire Dheirg, Glen Nevis (Macv.); Spean Bridge (Miss Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Jura (Ewing); Islay, several places, as Sgor Bhogachain, alt. 1000 ft., Cairnmore Wood, Ardimersay, Bridgend (Gilm.); Kildalton Woods (Ewing). *Mid Inner Hebrides:* Nr. Tobermory (Kenn.); Allt na Searmoin, cfr. (Kenn.). *N. Inner Hebrides:* Nr. Broadford (Macv.). *Outer Hebrides:* Tarbert (West).

Lower N. Highlands.—*W. Ross:* Ben Eay (How.); Kyle, cfr. (Macv.); Strome Ferry, c. (Macv.); Strathcarron, c. and also fr., f. (Macv.); Loch Maree (Miss Macv.). *E. Ross:* Achnasheen (Macv.); Loch Luichart (West).

Upper N. Highlands.—*E. Sutherland:* The Ord nr. Helmsdale (Lillie). *W. Sutherland:* Strath Halladale (Lillie); Strath Naver (Lillie). *Caithness:* Dorrery (Lillie); Ousdale (Lillie).

Orkney.—Hoy (Lillie); Cuilags, Hoy (Lillie).

Shetland.—Sullam nr. Lerwick (Sim); Unst (Sim); Bressay (West); Whalsey (Lillie).

Lepidozia Pearsoni *Spruce*

This Atlantic species, though widely distributed from Kirkcudbright to Orkney, is rare except on the west side of the Highlands. It is rare in the West Lowlands, having only been found in a few subalpine localities, and is very rare in the East Lowlands, only one locality, among subalpine species, being known. It has not been found in Fife, and only very sparingly in one locality near the coast of the East Highlands. It is rare throughout that province. In the West Highlands it is common in some districts and frequent in several, though rare in others. It is uncommon in the Inner Hebrides, and has not been yet found in the

Outer islands. Is frequent where it has been looked for in West Ross, but is apparently uncommon further north. This species is only found in very moist sheltered places, and is never found in the drier ground which *L. reptans* prefers. It grows most commonly as scattered stems among *Sphagnum*, and sometimes in compact layers on damp banks among *Sphagnum* and mosses; frequently also among erect mosses, as *Dicranum*. It is never found on exposed moors, and is seldom seen above 1000 ft. alt., though occurring to 1600 ft. alt. At such an altitude it grows sheltered by old heather or other herbage. Male plants are common; female plants are rather rare. The sexes seem never to occur in mixture.

S.W. Lowlands.—*Kirkcudbright:* Black Craig, New Galloway, alt. *ca.* 700 ft. (M'And.). *Wigtown:* W. of Luce above New Luce (Ewing).

N.W. Lowlands.—*Ayr:* Largs, with *Anastrepta orcadensis*, 1894, ♂ (Ewing). *Renfrew:* Nr. Glenlora, Misty Law (Scott).

E. Lowlands.—*Peebles:* Talla Linn, alt. 1000 ft. (Macv.).

S.E. Highlands.—*S. Perth:* Kinlochard, Aberfoyle, 1884, ♂ (Ewing).

Mid E. Highlands.—*Forfar:* Ravine, foot of Glenesk, among *Anastrepta orcadensis*, *Leptocyphus Taylori*, *Lophozia Floerkii*, and *Sphagnum*, 1860 (Croall).

W. Highlands.—*Kintyre:* Nr. Lochgilphead (Ewing). *Clyde Isles:* Loch Ranza, R. (Macv.). *Dumbarton:* Manse Burn, Arrochar, ♂, R. (Macv.) *Argyll:* Coire Athoich, ♂ (A. Murr.); Allt Coire Gabhail, Glencoe, alt. 1000 ft., with *Anastrepta orcadensis*, *Bazzania tricrenata*, *Scapania ornithopodioides* (Macv.); Kentallen, ♂ (Macv.); Glen Ure, Benderloch (Kenn.). *W. Inverness:* Moidart, ♂ R.C., ♀ R. (Macv.); Ardnamurchan (Macv.); Sunart (Macv.); Coire Dheirg, Glen Nevis (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Jura, ♂ (Ewing). *Mid Inner Hebrides:* Allt na Searmoin, ♂ (Kenn.). *N. Inner Hebrides:* Ben Cailleach, Broadford, ♂ and ♀, on heather slope from 1500-1600 ft. alt., with *Anastrepta orcadensis*, *Bazzania tricrenata*, *Scapania gracilis*, and *S. ornithopodioides* (Macv.).

Lower N. Highlands.—W. *Ross:* Strathcarron, ravine, c., ♂ and ♀ (Macv.).

Upper N. Highlands.—W. *Sutherland:* Ben Laoghal (Lillie). *Caithness:* Morven, above 2000 ft. alt., ♂ (Lillie); Scarabin (Lillie).

Orkney.—Ward Hill, Hoy, with *Saccogyna*, *Lophozia quinquedentata*, *Scapania gracilis* (Lillie); Segal Burn, Hoy (Lillie).

Lepidozia trichoclados *C. Müll. Frib.*

Widely distributed from Kirkcudbright to Orkney. As it is almost confined to peaty soil, it is absent over most of the agricultural region. It is rare in the West Lowlands, though frequent in part of the hilly district of Kirkcudbright, and it has not been found in the Upper Clyde district. Is very rare in the East Lowlands, even in the peaty districts. Is rare in Fife, and uncommon, at least, in the eastern part of the East Highlands. Towards the western boundary of this province it becomes more frequent, and is common in some localities. In the West Highlands and West Ross it is common wherever there are moist peaty banks on the low ground. It is uncommon or rare in those districts of the Hebrides which have been searched for it. Is frequent in Caithness and doubtless in similar situations over the North Highlands. It is rare in Orkney, and it has not been found in Shetland. Over the whole of the West Highlands this is the usual species of moist peaty banks, while *L. setacea* is the usual species of peat-moors, though both plants are found in either situation; the present plant is, however, more partial to shade. It is most common on the low ground, especially on moist shady banks; it also is found on stumps. It has been found up to 1800 ft. alt., but probably reaches higher. This species forms large dark-green cushions when on banks. It is frequently found as thin tufts or scattered stems among other species. Fruit is frequent in October and November.

S.W. Lowlands.—*Kirkcudbright:* Garroch Loch, ♀ (M'And.); Loch Trool (Macv.).

N.W. Lowlands.—*Ayr:* Barskimming Moor (Scott).

E. Lowlands.—*Edinburgh:* Hawthornden Grounds, ♀ (Evans). *Linlithgow:* Crawhill, on shady rocks by the Avon, ♀ (Evans).

S.E. Highlands.—*Fife and Kinross:* Lomonds, nr. Mawcarse, ♀ (Evans). *S. Perth:* Trossachs, ♂ and ♀ (Ewing). *Mid Perth:* Craig-an-Lochain, per., 1889 (West); Achrioch Wood, v.c. on stumps (Macv.); Craig Chailleach (Ewing). *N. Perth:* Glen Thaitneich, 1879 (Ferg.); Ben Gulabin, per. (Ewing and Young).

Mid E. Highlands.—*Forfar:* Nathro (Ferg.); Clova (Aimer). *Kincardine:* Kerloch, ♀, 1878 (Sim). *N. Aberdeen:* Mormond Hill (Ewing).

N.E. Highlands.—*E. Inverness:* Glen Tromie, alt. 1000 ft. (Ferg.).

W. Highlands.—*Clyde Isles:* Loch Ranza, v. (Macv.). *W. Stirling:* Rowardennan (M'And.). *Argyll:* Loch Tulla, c. (Macv.); Ben an Dothaidh (Ewing and Macv.); Coire Gabhail, Glencoe, alt. 1000 ft. (Macv.). *W. Inverness:* Choir Arder, 1879 (Ferg.); Moidart, c. and cfr. r.c. (Macv.); Morar (West).

Inner Hebrides.—*Mid Inner Hebrides:* Allt na Searmoin (Kenn.).

Outer Hebrides.—Tarbert (West); Balallan ♂ and ♀ (West).

Lower N. Highlands.—*W. Ross:* Kyle, c. (Macv.); Strathcarron, c. (Macv.); Loch Maree (Miss Macv.).

Upper N. Highlands.—*W. Sutherland:* Ben Clibreck, per. (Lillie). *Caithness:* Morven (Lillie); Langwell Deer Forest, ♀ (Lillie); Camster (Lillie); Watten, ♂ and ♀ (Lillie); Scouthill (Lillie).

Orkney.—Kirkwall, ♀ (West).

Lepidozia setacea (*Web.*) *Mitt.*

Generally distributed and frequent over the whole of the country where peat is present, from Kirkcudbright to Shetland. Is frequent and sometimes common in peat-mosses in the West Lowlands, and frequent on peaty banks where these are present on the hills. It is also frequent on some peat-mosses of the East Lowlands and on many of the hills which have moist, peaty banks. On such banks of the

Southern Uplands the plant often occurs in a form which greatly resembles *L. trichoclados* in habit. Over the whole of the Highlands, except in the cultivated parts, this species is found, though in some districts uncommon. It is to some extent independent of peat in the Highlands, being found occasionally on loamy banks and about tree roots. It is especially in the West Highlands, Hebrides, and North Highlands that this species occurs in the greatest quantity, being very common in peat-mosses. Is also common where there is peat in Orkney and Shetland. It is more common on the low ground of the Highlands than on the hills, but it has been found up to 3300 ft. alt. in North Perth.

Forms dark-green compact cushions as in the case of *L. trichoclados*, but not so large, or so frequently. It is more frequently in small tufts or in mixture with other species. Sterile female flowers are common; fruit is very rare. The male plant is rather uncommon.

S.W. Lowlands.—*Dumfries:* Sanquhar Moor (Macv.). *Kirkcudbright:* Criffel, 1840 (Cruicks.); nr. Darvalloch, per. (M'And.); Glen Trool, peat-moss (Macv.). *Wigtown:* Knowe (Ewing); nr. New Luce (Ewing).

N.W. Lowlands.—*Renfrew:* Nr. Loch Thom (West). *Lanark:* Leadhills, on wet peat (Lyon); Elvanfoot district, c. in peat-mosses (Macv.); Lousiewood Law, on peaty banks, alt. 1900 ft., f. (Macv.).

E. Lowlands.—*Peebles:* Tweedsmuir (Macv.). *Haddington:* Above Gifford, ♀ (Evans). *Edinburgh:* Auchendinny Woods, 1820 (Grev.); Balerno Moss, ♀ (M'And.).

S.E. Highlands.—*Fife and Kinross:* Lomond Hills (Ewing); Begg Wood (Young). *S. Perth:* Trossachs (Ewing). *Mid Perth:* Ben Lawers (Barker); do., alt. 2500 ft. (Macv.); Meal Ghaordie (Young). *N. Perth:* Glas Thalachan, alt. 3300 ft. (Ferg.); Glen Beg, Glen Shee (Ferg.); Den of King's Seat (Ferg.).

Mid E. Highlands.—*Forfar:* Loch Brandy (Gard.); foot of Glenesk (Croall); Fern (Ferg.); Nathro Burn (Ferg.); Sidlaws, ♀ (A. Downie). *Kincardine:* Dalfro (Sim); Kerloch (Sim); Mount Shade (Sim). *S. Aberdeen:* Glen Callater (Dickie); Dhu Loch (Dickie); Lochnagar (Sim); do. (Stabl.); Ballochbuie (Michie); Glen Beg, Braemar (Stabl.).

N.E. Highlands.—*E. Inverness:* Carn Dearg, Aviemore (Macv.); above Lochan Dorb, Nairn (Miss Macv.).

W. Highlands.—*Kintyre:* Between Ardrishaig and Tarbert (Ewing). *Clyde Isles:* Peat-moss nr. Loch Ranza, per. (Macv.). *Dumbarton:* Ben Vorlich (Macv.). *Argyll:* Puck's Glen (A. Murr.); Glencoe (Macv.). *W. Inverness:* Moidart, c. in peat-moors (Macv.); Ardnamurchan, do. (Macv.); Sunart, do. (Macv.); Ben Nevis (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Sgor Bhogachain, Islay, alt. 1000 ft. (Gilm.); Cairnmore Wood, Islay (Gilm.). *N. Inner Hebrides:* Broadford district, r.c. (Macv.).

Lower N. Highlands.—*W. Ross:* Kyle (Macv.); Strathcarron, c. (Macv.). *E. Ross:* Achnasheen (Barker); do. (Macv.).

Upper N. Highlands.—*E. Sutherland:* Strath Ullie (Lillie). *W. Sutherland:* Ben Clibreck (Lillie). *Caithness:* Several localities, as Langwell, Watten, etc. (Lillie).

Orkney.—Kirkwall (West); Hoy (Lillie).

Shetland.—Northmaven (Sim); Uni Firth, sides of peat-holes (Grieve).

var. sertularioides (*L.*)

S.W. Lowlands.—*Dumfries:* Solway Moss (Scott). *Wigtown:* New Luce Moor (M'And.).

N.W. Lowlands.—*Lanark:* Lousiewood Law, f. (Macv.); Kirk Burn, Tinto, and at 1900 ft. alt. (Macv.).

E. Lowlands.—*Peebles:* Moor S. of Leadburn, ♀ (Evans); Carton Burn, on turfy sheep-drains, ♂ and ♀, alt. 1200 ft. (Macv.); Logan Water, on heathery bank, ♂ and ♀, alt. 1250 ft. (Macv.). *Berwick:* Nr. Seenes Law (Evans). *Haddington:* Dunbar Common (Evans). *Edinburgh:* Balerno Moss, ♀ (M'And.); Auchencorth Moss (Evans).

S.E. Highlands.—*Fife and Kinross:* Moss Morran (Young). *S. Perth:* Blair Drummond Moss, ♀ (Evans).

Mid E. Highlands.—*S. Aberdeen:* Braemar, 1856 (Croall).

W. Highlands.—*W. Inverness:* Moidart, c. (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Jura (Ewing). *Mid Inner Hebrides:* Loch Mishnish and Loch Frisa, per. (Macv.).

Outer Hebrides.—Benbecula (West).

Upper N. Highlands.—*E. Sutherland:* Nr. Ben Roscie

(Lillie). *W. Sutherland*:—Forsinard, ♀ (Lillie); between Durness and Tongue (Lillie).

Orkney.—Hoy, ♀ (Lillie).

Shetland.—Yell (Sim); Unst (Sim).

BLEPHAROSTOMA Dum.

Blepharostoma trichophyllum (*L.*) *Dum.*

Generally distributed in the subalpine and alpine regions from Dumfries to Shetland. It is very rare in those districts where the rock does not appear on the surface. This applies especially to large tracts in the Southern Uplands. It is uncommon as a whole in the West Lowlands, though frequent in some subalpine glens. Is very rare in the Upper Clyde valley, where little rock is to be seen. It is rare in the East Lowlands, and with a few exceptions is confined to the upper reaches of the Tweed and its tributaries. It has only been found to be frequent in Tweedsmuir above 900–1000 ft. alt. It is rare in Fife, but is frequent throughout the hilly regions of the Highland provinces and is common in many districts. It does not appear to have any special distribution as long as moist rocky banks are present. It is common on schistose formations, occurs also on limestone, but it appears to be less common on granite. It is frequent in the Inner Hebrides, but has not yet been found in the Outer islands or in Orkney, and it appears to be uncommon in Shetland. In several of our islands there is a want of moist rocky banks, in which these species and some others are usually to be found. Although most common in the subalpine region, it is also rather common on the higher ground, and ascends to 4000 ft. alt. in Mid Perth. It has not been recorded above 2100 ft. alt. in the West Highlands.

Grows in light-green, compact tufts, or more commonly in mixture, and is occasionally found on stumps as well as on banks. Fruit, mature from April to July, is almost confined to the compact states, where it is frequent, and sometimes abundant.

Near Glasgow, 1836 (Lyon).

S.W. Lowlands. — *Dumfries:* Penton Linn (Scott); Moffat, per. (M'And.); Euchan Water and Crawick Water, u. (Macv.). *Kirkcudbright:* Above Routing Bridge, 1840 (Cruicks.); Dalskairth Woods (Cruicks.); New Galloway (M'And.). *Wigtown:* W. of Luce, above New Luce (Ewing).

N.W. Lowlands. — *Renfrew:* Lochwinnoch (Ewing); Loch Thom (Ewing). *Lanark:* Stream S. of Elvanfoot, v.r. (Macv.); head of Evan Water (Macv.).

E. Lowlands.—*Peebles:* Cowie's Linn (A. Murr.); Carton Burn, alt. 1200 ft., v.r. (Macv.); Tweedsmuir, f. above 900–1000 ft. (Macv.). *Selkirk:* Crosscleugh Burn (Evans). *Edinburgh:* Logan Burn (A. Murr.); Nether Habbie's Howe, per. (Evans).

S.E. Highlands.—*Fife and Kinross:* Lomond Hills (Young). *E. Stirling:* Baston Burn (K. & S.); Causeway-end (Evans). *S. Perth:* Strathyre (Macv.); Trossachs, cfr. (Evans); Tillicoultry Glen (Evans). *Mid Perth:* Craig Chailleach (Hook. *cf.* Brit. Jung., p. 7); Schiehallion (Hook. *loc. cit.*); Ben Lawers nr. summit (Dixon); Killin district, v.c. both on low ground and hills (Macv.); Ben Laoigh (Dixon); Tyndrum district, l.c. on low ground and r.c. on the hills (Macv.); nr. Inver (M'In.); Rumbling Bridge, nr. Dunkeld (Holmes). *N. Perth:* Falar (Barker); Den of King's Seat (Ferg.); Glen Tilt (Ferg.); Glas Thulachan (Ferg.); Ben Gulabin (Ew. and Young).

Mid E. Highlands.—*Forfar:* Foot of Glenesk, cfr., 1856 (Croall); Clova, alt. 2300 ft. (Ferg.); Auchphersie (Ferg.); Camlochan (Ferg.); Denoon Glen (Aimer); Reeky Linn (Aimer). *Kincardine:* Blackhall, per. (Sim); Dalfro (Sim). *S. Aberdeen:* Ben MacDhui, 1836 (Croall); Balmoral (Stabl.); Coire Ceandor (Ewing).

N.E. Highlands.—*E. Inverness:* Carn Beag, Aviemore, alt. 1200 ft. (Macv.); Invercannich (Cocks).

W. Highlands.—*Kintyre:* Between Ardrishaig and Tarbert, cfr. (Ewing). *Clyde Isles:* Loch Ranza, r. (Macv.); *Dumbarton:* Ben Vorlich (Macv.); Arrochar, c. (Macv.). *W. Stirling:* Rushnagh Glen, Rowardennan (K. & S.). *Argyll:* Lismore (Macv.); Ben Arthur (Ewing); Ben More, Loch Eck, etc. (A. Murr.); Glen Nant, u. (Macv.); Ben Cruachan, r. (Macv.); Ballachulish (Macv.); Glen Lochy (Macv.); hills nr. Kilmun (Scott); Kentallen (Macv.).

W. Inverness: Choir Arder, per., 1879 (Ferg.); Moidart, c. (Macv.); Ardnamurchan, c. (Macv.); Sunart, c. (Macv.); Morar (West).

Inner Hebrides.—*S. Inner Hebrides:* Jura, per. (Ewing). *Mid Inner Hebrides:* Nr. Tobermory (Kenn.); Allt na Searmoin (Kenn.). *N. Inner Hebrides:* Mill Burn, Broadford, c. (Macv.).

Lower N. Highlands.—*W. Ross:* Kyle, c. (Macv.); Strathcarron, c. and fr. f. (Macv.); Gairloch (Miss Macv.).

Upper N. Highlands.—*E. Sutherland:* Ben Griam Mohr (Lillie); nr. Rogart (Lillie). *W. Sutherland:* Ben Laoghal (Hook. *cf.* Brit. Jung., p. 7); Farr, per. (Lillie). *Caithness:* Reisgill Burn (Lillie).

Shetland.—Nr. Cullivoe, Yell (Sim); Loch of Cliff and Saxa Vord, Unst (Lillie).

CHANDONANTHUS Mitt.

Chandonanthus setiformis (*Ehrh.*) *Lindb.*

This species is almost confined to the granite of the North-Eastern Highland mountains, where it is found in some quantity. It has also been found sparingly on the granite of Ben Nevis and in Caithness. Although its distribution with us is mainly an eastern one, this may depend on the circumstance that the only extensive hill formation of granite happens to be on the eastern side. The altitude to which the species ascends has not been ascertained. It descends to 1800 ft. as the typical form. The var. *alpinus*, to which nearly all our plants belong, has been noted down to about 900 ft. alt. This species grows in reddish-yellow tufts on rocks and among boulders in usually rather dry ground. No inflorescence has been seen.

Scotch Alps (Dickson and G. Don *cf.* Hook. Brit. Jung., p. 20).

S.E. Highlands.—*Mid Perth:* Ben Lawers (*cf.* Hook. Brit. Jung., p. 20); Schichallion (Hook. *loc. cit.*).

Mid E. Highlands.—*Forfar:* Catlaw, Oct. 1813 (C. Lyell in Herb. Carrington *cf.* Pearson); Clova Mountains

(G. Don *cf.* Hook. Fl. Scot., p. 114); do., 1824 (Grev.); do., 1836 (Gourlie); Glen Dole, 1843 (Gard.); Ben Red (Gard.); Clova, 1876 (Ferg.); Glen Fee, Clova (Ferg.). *Kincardine:* Slack of Birnie, 1880 (Sim). *S. Aberdeen:* Ben Bourd, 1822 (Grev.); Panmanich Crags, 1840 (Dickie); Ben MacDhui, 1856 (Croall); Birse (Sim); Balmoral (Stabl.); Lochnagar (Croall); do., with *Anast. orcadensis* and *Bazz. tricrenata* (Stabl.); Balmoral, on a frequently submerged stone (Michie); Moronne (Holmes).

N.E. Highlands.—*E. Inverness:* Cairn Gorm, 1822 (Grev.); summit of Cairn Gorm (Hook. *cf.* Brit. Jung., p. 20); Carn Dearg, Aviemore, alt. 1200 ft., 1889 (Macv.).

W. Highlands.—*W. Inverness:* Ben Nevis, 1820 (Grev. in Herb. Carrington *cf.* Pearson); do. (Hook. *cf.* Brit. Jung. p. 2); do., alt. *ca.* 2000 ft. 1908 (J. B. Duncan and H. H. Knight).

Upper N. Highlands.—*W. Sutherland:* Ben Laoghal, (Hook. *cf.* Brit. Jung., p. 2). *Caithness:* Morven (Lillie).

ANTHELIA Dum.

Anthelia julacea (*L.*) *Dum.*

Widely distributed over the subalpine and alpine regions of the Highland provinces, but very local in the Lowlands. In the West Lowlands it has only been found on the Kells range and Merrick Hills of Kirkcudbright and Ayr. "Is common on the Kirkcudbrightshire hills, descending to about 200–300 ft., though probably washed down at this altitude" (M'Andrew *in litt.*). It appears to be absent from the East Lowlands, and almost from the whole east coast neighbourhood, and for some miles inland in the East Highlands. Frequent in the Eastern Grampians, it becomes common towards the west. In the West Highlands it is one of the commonest species on the hills, descending to 200 ft. alt. in Arran, and to sea-level in West Inverness. It is rather common in many parts of the low ground in the West Highlands, but it only becomes very common above 1200 ft. alt. Is mostly uncommon in the Inner Hebrides, where there is little peaty soil on the

hills. In the Outer islands it has been found in several places. It is probably frequent in the North Highlands, but its distribution is not yet well known there, and it is very rare or absent in Caithness. It has only been found in one locality in Orkney, and seems to be rare in Shetland. It ascends to the summit of the hills in Mid Perth, and to the summit of Ben Nevis at 4400 ft. alt. Grows in dark-green patches, often of several feet in diameter, on wet stony ground, in peaty soil, or as thick patches on rocks. Is also frequent on damp footpaths on the low ground of the West Highlands. Fruit, mature from June to August, is common, but the large masses are generally sterile.

Ben Lomond (Light. *cf.* Flor. Scot., p. 785).

S.W. Lowlands.—*Kirkcudbright:* Burnfoot Hill, New Galloway (M'And.); Milyea (M'And.); Merrick (J. Murr.); Corserine (West); Lammachan, alt. 1600–1800 ft. (West).

N.W. Lowlands.—*Ayr:* Pulskay Burn (G. West).

S.E. Highlands.—*Fife and Kinross:* Lomond Hills (Ewing). *South Perth:* Ben Ledi, 1841 (W. Gorrie in Ed. Herb.); Cruach Ardran (K. & S.); nr. Loch Katrine (How.). *Mid Perth:* Stuichd-an-Lochain, 1841 (Gard.); Tyndrum (Croall); do., c. on the hills (Macv.); Killin Hills, c. to 4000 ft. alt. (Macv.); Ben Heasgarnich (Ewing); Coire Ardran, c. (Macv.). *North Perth:* Meal Vain, Glen Shee, alt. 1700 ft. (Ferg.).

Mid E. Highlands.—*Forfar:* Glen Dole, cfr., 1853 (Croall); Clova (Ferg.); Camlochan (Ferg.). *S. Aberdeen:* Ben na Buird, 1844 (Gard.); Glen Callater, 1845 (Gard.); Lochnagar (Gard.); do. (Dickie); Ben Avon, cfr., 1854 (Croall); Ben MacDhui (Dickie); do., alt. 4000 ft. (West); Braemar (Croall); Finzean (Sim); Coire Ceandor (West).

N.E. Highlands.—*Banff:* Loch Builg, 1840 (Dickie). *Elgin:* Above Sluie, 1848 (Croall). *East Inverness:* Coire Ghlas, Glengarry, 1867 (How.); Mam Soul (Cocks); Braeriach (Wilson and Wheldon).

W. Highlands.—*Kintyre:* Nr. Lochgilphead (Ewing). *Clyde Isles:* Goatfell (Light. *cf.* Flor. Scot., p. 785); Arran, without nearer locality, 1855 (How.); L. Ranza, alt. 200 ft. (Macv.); Cairn na Cailleach, c. (Macv.). *Dumbarton:* Ben Vorlich, v.c. also cfr. (Macv.); moss behind Cairloch (Scott).

West Stirling: Ptarmichan (K. & S.). *Argyll:* Argyllshire, 1846 (Stark); Ben Cruachan (Croall); do., v.c. also fr. (Macv.); head of Loch Awe, L.C. on the low ground (Macv.); Loch Bhe, roadside (Macv.); Ben Udlaidh, C. (Macv.); Inverchapel Burn (A. Murr.); King's House (Barker); Ben Ime (Lee); Bridge of Orchy, v.c. (Macv.); Ben Doureann, v.c. (Macv.); Ben Arthur, alt. 500–2600 ft., R.C. (Macv.); Glencoe (West). *West Inverness:* Moidart, F. on low ground, v.c. on the hills (Macv.); Ardnamurchan, F. (Macv.); Sunart, C. (Macv.); Glen Nevis, C. (Macv.); Ben Nevis (Macv.); do., 4400 ft. (J. B. Duncan and H. H. Knight).

INNER HEBRIDES. — *Mid Inner Hebrides:* Ben More, Mull (Kenn.). *North Inner Hebrides:* Sligachan (Ewing); nr. Mill Burn, Broadford, alt. 100 ft. (Macv.).

OUTER HEBRIDES. — Barra (Ewing); Tarbert (West); Clisham (West); Balallan (West).

LOWER N. HIGHLANDS. — *West Ross:* Ben Slioch, 1867 (How.); Glasven (Macv.). *East Ross:* Achnasheen, alt. *ca.* 600 ft. (Macv.).

UPPER N. HIGHLANDS. — *East Sutherland:* Ben Griam Mohr (Lillie). *West Sutherland:* Ben Clibreck (Lillie).

ORKNEY. — Hoy (Dr Grant).

SHETLAND. — Northmaven (Sim); Bergs of Skelberry, Northmaven, alt. *ca.* 500 ft. (Beeby).

ANTHELIA JURATZKANA (*Limpr.*) *Trevis*
Jung. nivalis Sw.

This species is frequent on the higher hills of the East and West Highlands, and is probably common on several, though apparently rarer on the west side of the country. Its distribution in the North Highlands is little known, but it takes the place of *A. juliacea* in Caithness. It has not been found in the Hebrides, nor in Orkney or Shetland. As this species is stated to occur frequently in large sterile masses as does *A. juliacea*, the comparative distribution of the two is more difficult to learn; but as fruit is common in both, and in this condition can be readily distinguished, we find that *A. Juratzkana* rarely descends below 1900 ft. alt., and that it ascends to 4300 ft. alt. at least on Ben

Nevis. On moist, bare, peaty soil it occurs in small patches, which are generally with fruit from June to August.

S.E. Highlands.—*Mid Perth:* Ben Lawers, 1880 (West *cf.* Pears. Hep. Brit., p. 98); Ben Laoigh, 1882 (Ewing *cf.* Pears. *loc. cit.*); Killin Hills, f. from 1900 ft. alt. on Craig-an-Lochain to 4000 ft. alt. on Ben Lawers, fr. c. (Macv.); Ben Heasgarnich, nr. summit, with *Gymno. concinnatum*, per. (West); Ben Dubh Craige, summit, cfr. (Macv.); Ben Odhar, alt. 2800 ft. (Macv.); Ben Laoigh, alt. *ca.* 2600 ft. (Macv.); Cairn Gorm, Rannoch, alt. *ca.* 3200 ft., with *Nardia Breidleri* (W. E. Nicholson). *N. Perth:* Glas Thulachan, with *Gymno. concinnatum*, alt. 3400 ft., cfr., 1879 (Ferg.).

Mid E. Highlands. — *Forfar:* Camlochan, per., 1873 (Ferg.); do., cfr. (Ew. and Young). *S. Aberdeen:* Glen Callater, 1841 (Prof. J. H. Balfour *cf.* Pears. Hep. Brit., p. 98); Coire Ceanmor, cfr. (Ew. and Young).

N.E. Highlands.—*E. Inverness:* Cairn Gorm, alt. 3200 ft., per. (Macv.); do., Coire Schneachd (Macv.).

W. Highlands.—*Argyll:* Ben Doureann, cfr., c. from 3400 ft. alt. (Ewing and Macv.); summit of Ben Arthur, with *Gymno. concinnatum*, cfr. f. (Macv.). *W. Inverness:* Ben Nevis, cfr., August 1880 (West *cf.* Spruce On Ceph., p. 82); do., f. from 2600–4300 ft. alt., cfr. (Macv.).

Upper N. Highlands.—*W. Sutherland:* Ben Clibreck, with *Gymno. concinnatum*, per. (Lillie). *Caithness:* Morven, with *Gymno. concinnatum*, cfr. (Lillie); do., per. (Lillie).

HERBERTA S. F. Gray

Schisma Dum.

Herberta adunca (*Dicks.*) *Gray*

This Atlantic species is generally distributed over the West Highlands, and especially so on the hills, where it is often common. It is also rather common on several of the hills of the East Highlands towards the western side of that province, but on the eastern side it is rare and has only been found on the Forfar hills, its apparent absence from Aberdeen and North Perth hills being interesting. It is locally frequent on the Inner and Outer Hebrides, but

suitable localities on the islands are comparatively few. It appears to be uncommon in the North Highlands, though doubtless locally frequent in parts near the west coast; but it has not been found in the eastern half of the extreme north of the mainland, and is rare in Orkney and is at least uncommon in Shetland. This species descends to sea-level in the West Highlands and is sometimes frequent on the low ground. In the East Highlands it is only found on the hills, where it ascends to about 3400 ft. alt., though rare above 2900 ft. When on the low ground it grows on damp peaty banks in shady ground, generally among rocks. On the hills it grows on rock ledges and rocky banks, preferably moist; but not rarely it is found on rather dry and exposed bare ground. In this last position it is dwarfed and very dark in colour, sometimes nearly black, and with the leaves hardly or not at all falcate. In its usual somewhat sheltered localities it forms erect, reddish tufts, or scattered among other species, especially *Bazzania tricrenata*. Sterile female plants are not uncommon. Male plants have not been seen.

In Alpibus Scoticis (Dicks. *cf.* Pl. Crypt., Fasc. iii. p. 12, 1790); Ben Lomond (Hook. *cf.* Fl. Scot., p. 111).

S.E. Highlands. — *E. Stirling:* Glengyle (K. & S.). *Mid Perth:* Ben Lawers (Hook. *cf.* Brit. Jung., p. 4); Creag Chailleach, 1841 (Gard.); Glen Lyon, 1849 (Stark); Killin Hills, R.C. to 2900 ft. alt. (Macv.); Ben More, nr. summit (Dixon); Ben Heasgarnich (Meld.); Ben Laoigh (Dixon); do., v.c. (Macv.); Coire Ardran, v. (Macv.); Stuichd-an-Lochain (Gard.).

Mid E. Highlands.—*Forfar:* Camlochan, 1843 (Gard.); do., 1873 (Ferg.); Clova (Ferg.).

N.E. Highlands.—*E. Inverness:* Cairn Gorm (Hook. *cf.* Brit. Jung., p. 4); Coire Ghlas, Glengarry (How.).

W. Highlands. — *Kintyre:* Tarbert (Ewing). *Clyde Isles:* Arran, without other locality, 1845 (Stark). *Dumbarton:* Ben Vorlich, 1871 (Barker); do., c. (Macv.); Arrochar, R. (Macv.). *Argyll:* Ben Arthur (Hook. *cf.* Brit. Jung., p. 4); Glen Fyne, 1839 (W. W. Evans); Glencoe, alt. 1000 ft. (Macv.); Coire Athoich (A. Murr.); ravine on the low ground nr. Loch Awe Station (Macv.); Ben

Cruachan, v. (Macv.): Ben Udlaidh, alt. 2100 ft. (Macv.): Ben Doureann (Ewing and Macv.); Glen Ure (Kenn.); Ben More (A. Murr.): Kilmun Hills (Scott). *W. Inverness:* Ben Nevis (Hook. *cf.* Fl. Scot., p. 111); do. (Macv.); Coire Dheirg, Glen Nevis, c. at 1800 ft. alt. (Macv.); Moidart, l.c. on low ground to sea-level, v.c. on the hills to 1800 ft. alt. (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Jura (Ewing); Sgor Bhogachain, Islay, alt. 1000 ft. (Gilm.). *Mid Inner Hebrides:* Nr. Tobermory (Kenn.); Allt na Searmoin (Kenn.); Ben More (Kenn.). *N. Inner Hebrides:* Ben Cailleach (Hook. *cf.* Brit. Jung., p. 4): do., v., alt. 800–1600 ft. (Macv.); nr. Loch Coruisk (Barker).

Outer Hebrides.—Tarbert (West); Balallan (West).

Lower N. Highlands.— *W. Ross:* Ben Eay, 1867 (How.); Ben Liath Mohr, v. (Macv.); Strathcarron, r. (Macv.).

Upper N. Highlands.—Sutherland, 1834 (Grev.).

Orkney.—Hoy (Dr Grant).

Shetland.—Unst (Sim); Muckle Heog Cairns, Unst (Lillie).

MASTIGOPHORA Nees

Mastigophora Woodsii (*Hook.*) *Nees*

This rare Atlantic species is confined to the west side of the Highlands, though not ending in the western watershed, as it extends slightly over that into the East Highlands when that province approaches the west coast. This species extends from Dumbarton to Sutherland, and is found in some quantity on several of our hills from 1600 ft. to 2300 ft. alt. In one locality in Argyll it occurs at the low level of 1000 ft. alt. Its usual habitat is moist rock ledges, but it is found also on steep grassy or heathery slopes. It forms large reddish-brown patches, the colour being very similar to that of *Ptilidium ciliare*, and is either unmixed or among other species, especially *Scapania ornithopodioides, S. gracilis, Bazzania trierenata, Jamesoniella Carringtoni,* and *Anastrepta orcadensis.* Inflorescence has not been seen.

S.E. Highlands.—*Mid Perth:* Ben Laoigh, with *Anast. orcadensis*, *Leptocythus Taylori*, *Bazz. tricrenata*, *Jamesoniella*, *Scap. ornithopodioides*, alt. 1400–1800 ft., R. (Macv.); Ben Chuirm (Macv.).

W. Highlands.—*Dumbarton:* Ben Vorlich, with *Scap. ornithopodioides*, alt. *ca.* 2000 ft. (Macv.). *Argyll:* Glencoe, among boulders (Dixon); do., alt. 1000 ft. (Macv.); Coire Creachainn, Ben Cruachan, alt. 1900 ft., V.R. (Macv.). *W. Inverness:* Sciur Donald and Ben Gaire, Moidart, F. from 1600–1800 ft. (Macv.); Coire Dheirg, Glen Nevis, alt. 1800 ft., R. (Macv.); Ben Nevis, N. side, alt. 2300 ft., R. (Macv.).

Inner Hebrides.—*N. Inner Hebrides:* Ben Cailleach, Broadford, on steep heathery slope, alt. 1500–1600 ft., with *Anast. orcadensis*, *Bazz. tricrenata*, *Scap. ornithopodioides*, *S. gracilis*, F. (Macv.).

Lower N. Highlands.—*W. Ross:* Ben Eay, 1867 (How. and Jenner).

Upper N. Highlands.—Sutherland, 1843 (Grev.). *W. Sutherland:* Quinag (Dixon).

PTILIDIUM Nees

Blepharozia Dum.

Ptilidium ciliare (*L.*) *Hampe*

Widely distributed from Dumfries to Shetland, especially on the east side of the country. It is mostly confined to subalpine and alpine localities. Is uncommon in the West Lowlands generally, and is rare in many districts of that province, as in the Upper Clyde valley. In the East Lowlands it is locally frequent, but uncommon as a rule, and is rare in the Upper Tweed valley. In Fife and through most of the East Highlands it is frequent, and in many parts is rather common. In the West Highlands it is very rare near the coast, becoming less so on the hills some miles inland, but remaining uncommon. It is very rare in the Inner Hebrides, and has not been found in the Outer islands. Is rare in West Ross and apparently uncommon in most parts of the North Highlands, and is rare

in Caithness. It has only been found in Orkney in Hoy, but is quite a frequent species in Shetland. Its eastern distribution is most marked north of the Forth and Clyde, and it is rather surprising that it is not more common in Caithness and its neighbouring parts.

This species is most common on wet moors, and is sometimes present nearly submerged in bogs. On the hills it occurs on grassy banks or among heather, also on bare exposed ground or among *Rhacomitrium lanuginosum*. It has been found on the summit of two of our highest hills, at 4000 ft. alt., in the East Highlands, and is the only large hepatic in such a position. It is also found on several parts of the summit plateau of Ben Nevis to 4300 ft. alt. It occasionally is found on dry rocks in exposed places, but is usually with us in moist ground. When in very wet ground it forms compact, erect tufts of a light yellow-brown colour. Perianths are rather uncommon, and fruit very rare.

In ericetis Scoticis (Dicks. *cf.* Pl. Crypt., Fasc. ii. p. 14, 1790).

S.W. Lowlands. — *Dumfries:* Dalveen Pass (Scott); Well Hill, Moffat (Miss Macv.). *Kirkcudbright:* New Galloway (M'And.); Carsphairn Hills (Scott).

N.W. Lowlands.—*Ayr:* Nr. Ladyland (Scott). *Renfrew:* between Glenlora and Misty Law (Scott). *Lanark:* Wilsontown (Ewing); Lousiewood Law, alt. 1500 ft., v.r. (Macv.).

E. Lowlands.—*Peebles:* Moor nr. Cowie's Linn (Evans); banks among trees, Cowie's Linn (Evans); Millstone Rig (Evans); Dreva, r. (Macv.); Broughton district, r. (Macv.). *Berwick:* Nr. Scenes Law (Evans). *Haddington:* Lammer Law (Evans); Nr. Gifford (Evans); North Berwick Law, "c." (M'And.); Garleton Hill (Evans); Dunbar Common (Evans). *Edinburgh:* Pentland Hills (Grev. *cf.* Fl. Edin., p. 278); Auchincorth Moor (Evans); Braid Hills, on rocks (Evans); Corstorphine Hill (A. Murr.); Caerketton (Evans); Currie Moor (Evans). *Linlithgow:* Summit of Cocklerue (Evans).

S.E. Highlands.—*Fife and Kinross:* Lucklaw Hill, 1853 (How.); Stravithy Wood (How.); Lomond Hills

(Young); Duncarn Hill (Young); nr. Leuchars (Sim Herb.). *E. Stirling:* Earl's Burn Reservoir (K. & S.). *Mid Perth:* Schiehallion (F. R. Coles); Am Binnean, alt. *ca.* 3500 ft. (Evans); Sow of Athole (Meld.); Killin district, F., ascending to 4000 ft. on Ben Lawers (Macv.); Ben Heasgarnich (Young); Ben Laoigh, R.C. (Macv.); Ben Dubh Craige, F. (Macv.); Coire Ardran, 2000–2100 ft. (Macv.). *N. Perth:* Meal Uaim (Ferg.); Cairn na Glashan (West); Glas Meol (Stabl.); Ben Gulabin, and Glen Beg, on juniper (Ew. and Young); Glen Thaitneich, on wood (Ew. and Young).

Mid E. Highlands. — *Forfar:* Catlaw, per., 1814 (C. Lyell); Falls of Isla, 1838 (Gard.); Red Head, Forfar (Kerr); Clova, 1840 (W. Jackson); Glen Dole, cfr., 1846 (Gard.); do. (Ferg.); Nathro (Ferg.); Glen Fee (Ferg.); Dundee Law (Ferg.); Fern (Ferg.); White Hill, Sidlaws (Aimer). *Kincardine:* Mount Shade (Sim); Dalfro (Sim); Bogindreep Wood (Sim). *S. Aberdeen:* Sides of Lochnagar (Mr Brown *cf.* Wither. Arr. Brit. Pl., 7th ed., p. 1095); do., 1876 (Sim); Hill of Fare, 1840 (Dickie); Deerhill Wood, 1842 (Gard.); Ben MacDhui summit, alt. 4000 ft. (Dickie); Morrone summit, per., 1856 (Croall); Balmoral, on dead juniper bush, per. (Stabl.); do., on rock (Michie); Coire Ceandor (West); nr. Meal Odhar, alt. 3150 ft. (Ew. and Young).

N.E. Highlands.—*E. Inverness:* Cairn Gorm, 1822 (Grev.); do., on the summit, alt. 4000 ft. (Macv.); nr. Loch Vaa (Macv.); nr. Kingussie (Ferg.).

W. Highlands.—*Clyde Isles:* Cairn na Cailleach, alt. 1200 ft., V.R. (Macv.). *Dumbarton:* Ben Vorlich, F. (Macv.). *Argyll:* Ben More (A. Murr.); Coire Creachainn, Ben Cruachan, alt. 1800 ft., R. (Macv.); Ben Doureann, U. (Ewing and Macv.); Ben Arthur, alt. 2300 ft., R. (Macv.). *W. Inverness:* Moidart, V.R. (Macv.); Coire Dheirg, Glen Nevis, alt. 1800 ft. (Macv.); Ben Nevis, alt. *ca.* 2000, 3700, 4100, 4300 ft., U. (Macv.).

N. Inner Hebrides.—Ben Cailleach, Broadford, alt. 1500 ft. (Macv.).

Lower N. Highlands.—*East Ross:* Achnasheen (Macv.); Scuir na Lapaich (Cocks).

Upper N. Highlands.—*E. Sutherland:* Nr. R. Lettie

(Lillie). *W. Sutherland:* Ben Laoghal (Lillie). *Caithness:* Braemore (Lillie); Scarabin (Lillie).

Orkney.—Glen Trowie, Hoy (Lillie).

Shetland. — Yell (Sim); Lerwick (West); Bressay (West); Whalsey, several places (Lillie); Unst (Lillie).

Ptilidium pulcherrimum (*Web.*) *Hampe*

A rare species which is almost confined to the east side of the country. It has been found from Peebles to Aberdeen, but only in small quantity, and is more frequent in the Balmoral district than elsewhere. It is extremely rare on the west side of Scotland, and has only once been found there. It grows in flat patches about the roots of trees and on their stems, less frequently on rocks, in rather sheltered places. Perianths and fruit, the latter mature in July, are uncommon.

E. Lowlands. — *Peebles:* Cowie's Linn, on wood (A. Murr.). *Edinburgh:* Pentland Hills (A. Murr.); Hawthornden, on tree (M'And.); nr. Bavelaw Castle, at foot of tree (J. Hunter). *Linlithgow:* Carriber Glen, on wood (M'And.); Craigiehall Wood, on rocks (M'And.).

S.E. Highlands.—*Fife and Kinross:* Kinghorn, foot of tree (M'And.); Cullalo, foot of oak-tree (Evans); Gt. Fort Woods, on larch-tree (Aimer). *Mid Perth:* Finlarig Wood, stem of fir (Macv.).

Mid E. Highlands. — *S. Aberdeen:* Carn Fiachan, Balmoral, on granite rock, cfr., 1884 (Stabl.); Balmoral (Stabl.).

W. Highlands.—*Dumbarton:* Old Kilpatrick, on trunk of tree in glen, 1886 (D. A. Boyd).

TRICHOCOLEA Dum.

Trichocolea tomentella (*Ehrh.*) *Dum.*

Widely distributed from Dumfries to Caithness, but uncommon in general. Is rather rare in the West Lowlands, being frequent only in a few sheltered subalpine glens. Is very rare in the East Lowlands, and has only been found

in one locality in wet ground on a hillside. It has not been found in any of the numerous sheltered glens of that province. Is very rare in Fife, and rare near the coast of the East Highlands, but becoming frequent in some sheltered ravines further inland. In the West Highlands it is a frequent species and sometimes common. Is rare in the Inner Hebrides, and has not been found in the Outer islands. Is rare in the North Highlands, and especially in the extreme north. Its distribution in Scotland appears rather to follow that of the rainfall than any particular preference towards the west side of the country. It is quite a frequent species in some of the wetter parts of the centre of the country where there is shelter. Its absence in the more rainy districts of the East Lowlands may be owing to this absence of sheltered ground. Although it occasionally is found in marshy ground which is exposed, it is most at home on the moist or wet banks of a sheltered ravine. It is a low-ground species, though it has been found up to 1200 ft. alt. in Mid Perth. Its preference for subalpine districts in the Lowlands is doubtless due to the agricultural region having too small a rainfall.

Forms large light-green or cream-coloured cushions, frequently 2–3 feet in diameter. Fruit has not been seen.

S.W. Lowlands.—*Dumfries:* Eskdale, 1866 (How.); nr. Langholm (How.); above Durisdeer (Scott); Archbank, Moffat (Miss Macv.). *Kirkcudbright:* Dalskairth Woods, 1840 (Cruicks.); New Galloway (M'And.). *Wigtown:* Lochnaw (J. S. Stirling).

N.W. Lowlands.—*Ayr:* Near Ladyland (Scott). *Renfrew:* Glen, Misty Law (Scott). *Lanark:* Falls of Clyde, 1837 (Gour.); do. (Lyon).

E. Lowlands.—*Edinburgh:* Pentland Hills, 1856 (Nichol); spongy ground on hillside nr. Loganlee (Evans).

S.E. Highlands.—*Fife and Kinross:* Queich Glen (W. R. Thomson). *E. Stirling:* Baston Burn (K. & S.). *S. Perth:* Strathyre, c. in a ravine (Macv.); Aberfoyle (Evans); Trossachs (Ewing); Wharry Glen nr. Bridge of Allan (Evans). *Mid Perth:* Nr. Aberfeldy (Dicks. *cf.* Pl. Crypt., Fasc. ii. p. 15, 1790); foot of Ben Lawers (Grev. Herb.); Finlarig Burn, r. (Macv.); Braan, Inver (M'In.);

nr. St Fillans, alt. *ca.* 1200 ft. (Grieve). *N. Perth:* Kinnaird, 1844 ("A. B." in Ed. Herb.); Den of Reichip (M'In.).

Mid E. Highlands.—*Forfar:* Clova (Gard.? in Ed. Herb.); foot of Glenesk (Croall); Auchphersie (Ferg.). *Kincardine:* Den Fenella (Dickie); Den of Garol (Sim); Brae of Lathers (Sim); Banks of Feugh, Invery (Sim); Paldy Hill (Sim). *S. Aberdeen:* Braemar, 1856 (Croall); Potarch (Sim).

N.E. Highlands.—*E. Inverness:* Cawdor, Nairn, 1856 (Croall).

W. Highlands. — Loch Long, 1857 (Grev. Herb.). *Kintyre:* Without nearer locality (Ewing); Ronachan (Macrae). *Clyde Isles:* Nr. Lamlash (Evans); Goatfell (Campb.); Corrie road (Campb.); Loch Ranza, R.C. (Macv.). *Dumbarton:* Glenfinlas (D. Don *cf.* Hook. Fl. Scot., p. 117); Ardlui (Macv.); Arrochar Wood, C. (Macv.). *Argyll:* Ben More, Loch Eck (A. Murr.); Puck's Glen (Ewing). *W. Inverness:* Moidart, F. (Macv.); Ardnamurchan, F. (Macv.); Sunart, F. (Macv.); Arisaig (W. Boyd).

Inner Hebrides.—*S. Inner Hebrides:* Jura (Ewing). *Mid Inner Hebrides:* Tobermory, in marsh (Macv.).

Lower N. Highlands. — *W. Ross:* Ben Eay, 1867 (How.); Strathcarron, V.R. (Macv.). *E. Ross:* Without locality, 1872 (Barker); Falls of Rogie (M'In.).

Upper N. Highlands.—*Caithness:* Scourieclett, Watten (Lillie).

DIPLOPHYLLUM Dum.

Diplophyllum albicans (*L.*) *Dum.*

This is the commonest species in Scotland, and is common almost everywhere from sea-level to the summit of the hills. It grows in all kinds of situations, on soil, rocks, stumps, and trees, and in both moist and dry places, though preferring the former. It is common on the summit of the hills of the East Highlands up to 4000 ft. alt., and has been found on the summit of Ben Nevis at 4400 ft. alt. It is interesting to find that in Norway this species does not ascend to any considerable altitude, the highest being 600–

700 metres (Kaalaas). It is also a rare species in that country's high latitudes.

Grows in large or small light-green tufts, frequently covering rocks in moist districts, or scattered among other species, and is found on all formations, including limestone. Fruit, mature from April to June, is common, though sterile plants with perianths are abundant. Gemmæ are common.

I have seen some hundreds of specimens of this species, and from every county. It is unnecessary to give localities, as on any day excursion, almost anywhere, one could hardly fail to meet with it.

Diplophyllum taxifolium (*Wahl.*) *Dum.*

A rare species and confined to the higher mountains. As it is sometimes in mixture with *D. albicans*, it may be occasionally overlooked, but is rare even when allowance is made for this. It doubtless occurs, though sparingly, on most if not all our highest hills, as it has been found on those which have been most searched. It has been found to 3700 ft. alt. in the East Highlands and to 3600 ft. on Ben Nevis, and descending to 1800 ft. on the former and to 1700 ft. on the latter. Forms small green tufts on damp rock ledges or on bare soil, either pure or in mixture. Fruit has not been seen.

S.E. Highlands.—*Mid Perth:* Ben Lawers, 1885 (Binstead); do., several places to 3000 ft. alt. (Macv.); Ben Laoigh, per., alt. *ca.* 1800 ft. (Macv.); do., 3700 ft. alt. (Ewing); Ben Heasgarnich (Young). *N. Perth:* Glas Thulachan, alt. 3200 ft. (Ferg.).

Mid E. Highlands.—*Forfar:* Glen Fee, 1872 (Barker); Clova, 1876 (Ferg.). *S. Aberdeen:* Lochnagar, with *Gymn. concinnatum*, *G. obtusum*, and *Chand. setiformis*, 1856 (Croall); do., with *G. obtusum* and *Loph. alpestris* v. *gelida* (Sim).

W. Highlands.—*W. Inverness:* Moidart, R., descending to 1700 ft. alt. (Macv.); Ben Nevis, 3600 ft. alt. (Macv.).

Lower N. Highlands.—*E. Ross:* Scuir na Lapaich (Cocks).

Diplophyllum obtusifolium (*Hook.*) *Dum.*

This rare species has only been found in a few scattered localities. As it is usually found with us in mixture with *D. albicans*, it is probably overlooked to some extent. It appears to be rather an eastern than a western species in Scotland. It grows on loamy banks with such species as *D. albicans*, *Calypogeia* species, *Ceph. bicuspidata*, *Haplozia crenulata* v. *gracillima*, and *Scapania curta*. Perianths are usually present, and fruit is probably common in spring.

N.W. Lowlands.—*Lanark:* Cathkin Hills (Hopkirk *cf.* Hook. Fl. Scot., p. 115).

S.E. Highlands.—*Fife and Kinross:* Near Newburgh (D. Don *cf.* Hook. Fl. Scot., p. 115). *N. Perth:* Nr. Dunkeld, Aug. 1855 (W. F. Buist in How. Herb.).

Mid E. Highlands.—*Forfar:* Sidlaw, cfr., on rotten stump in Balkalk Den (J. Fulton). *Kincardine:* Gateside, Strachan, with *Diplo. albicans* and *Ceph. bicuspidata*, 1878 (Sim). *N. Aberdeen:* Mormond Hill, with *Diplo. albicans* (Ewing).

W. Highlands.—*W. Inverness:* Moidart, per., on loamy banks with *Diplo. albicans* (Macv. and W. H. Pearson); Ardnamurchan, per., on loamy bank by roadside (Macv.).

Shetland.—Unst, per. (Lyon in Dickie Herb.).

SCAPANIA Dum.

Scapania compacta (*Roth.*) *Dum.*

Widely distributed from Dumfries to Shetland, but uncommon, especially towards the extreme north. It appears to be rather more frequent on the east side of the country than on the west. Is rare in general in the West Lowlands, though locally frequent, and is uncommon over most of the East Lowlands, and rare in the Upper Tweed district. It has been found widely spread over the East Highlands, but is nowhere common. Is generally rare over the West Highlands and the Hebrides. It is rare in the North Highlands, and has not been found in Orkney, though extending to Fair Isle and Shetland. Is confined

to the low ground, hardly ascending above 1000 ft. alt. Forms compact light-brown patches, sometimes of considerable extent when on rocks, on banks, on old walls, rocks and boulders, and sometimes in gravelly detritus at the side of streams in similar situations to *S. subalpina*. It prefers moist and rather shaded localities, and is frequently close to the sea-shore when in the West Highlands. It has been found on schistose, gneissic, and basaltic rocks, but not on limestone. Fruit is common from March to July, and also is found in late autumn. Gemmæ are common.

S.W. Lowlands.—*Dumfries:* Crichope, on wall, cfr. (Macv.). *Kirkcudbright:* Knockmarling Burn (M'And.); Penkill Burn, cfr. (Macv.); Glen Trool, on wall (Macv.). *Wigtown:* Knowe, cfr. (Ewing); nr. New Luce (Ewing).

N.W. Lowlands.—*Ayr:* Largs, per. (Ewing); Maich Water nr. Ladyland (Scott). *Renfrew:* Kelly Glen, per. (Ewing); Langbank (Campb.); Glen, Misty Law (Scott); Cloch, per. (Macv.). *Lanark:* Elvanfoot, cfr., R. (Macv.).

E. Lowlands.—*Peebles:* Rocks by roadside, Dreva, R. (Macv.). *Selkirk:* Bowhill (Evans). *Haddington:* Gullane Links (M'And.); Traprain Law (Evans). *Edinburgh:* Pentland Hills (A. Murr.); Loganlee Reservoir (Evans); Torduff Reservoir (Evans); Corstorphine Hill, per. (M'And.). *Linlithgow:* Riccarton Hills (Evans); Craigie Hill (Evans); Niddrie Burn, Winchburgh (M'And.).

S.E. Highlands.—*Fife and Kinross:* Tents Muir, 1864 (How.); Lomond Hills (Young); Orrock Hill (Young); Aberdour (Evans); West Lomond Hill, per. (Evans); Dunearn Hill (Evans); Bishop Hill (Evans). *E. Stirling:* Murrayshall, on old wall (Evans). *S. Perth:* Menstrie Glen, cfr. (Croall); do. (Evans); Strathyre (J. Hunter). *Mid Perth:* Finlarig Burn, cfr. (Ewing); Achroich Wood, cfr. (Macv.); Craig Vinean (M'In.); St Magdalene's Wood nr. Perth (Meld.). *N. Perth:* Glas Thalachan (Ewing).

Mid E. Highlands.—*Forfar:* Reeky Linn, 1842 (Gard.); foot of Glenesk, cfr., 1862 (Croall); Shielhill (Ferg.); Glenogil, per., alt. 1000 ft. (Ferg.). *Kincardine:* Bogindreep (Sim); Den of Lathers (Sim); Feugh Rocks, per. (Sim); Blackhall (Sim). *S. Aberdeen:* Dry Den, cfr. (Dickie); Birse (Sim); Craigendarroch (Ferg.).

N.E. HIGHLANDS.—*E. Inverness:* Craigellachie, Aviemore, per. (Macv.); Loch Vaa (Miss Macv.); Kincraig, cfr. (Miss Macv.).

W. HIGHLANDS. — *Kintyre:* Nr. Lochgilphead, per. (Ewing). *Clyde Isles:* Bute (Ewing); Loch Ranza (Macv.). *Dumbarton:* Arrochar, Manse Burn (Macv.). *W. Stirling:* Campsie (Ewing); Strathblane (Campb.). *Argyll:* Lochan Bhe, at roadside (Macv.); nr. Ballachulish Ferry (West). *W. Inverness:* Moidart, f. (Macv.).

INNER HEBRIDES.—*S. Inner Hebrides:* Jura (Ewing). *Mid Inner Hebrides:* Dervaig, Mull, on roadside bank (Macv.).

OUTER HEBRIDES.—Roadside from Balallan to Tarbert (West).

LOWER N. HIGHLANDS.—*E. Ross:* Achnasheen (Macv.).

UPPER N. HIGHLANDS.—*E. Sutherland:* Nr. Rogart (Lillie). *W. Sutherland:* Strath Halladale, per. (Lillie). *Caithness:* Dunbeath Strath (Lillie).

SHETLAND.—Fair Isle, per. (Miss Skene); Outskerries (Lillie).

SCAPANIA SUBALPINA (*Nees*) *Dum.*

Generally distributed in the subalpine and alpine parts of the country from Dumfries to Shetland. Is frequent in some parts of the West Lowlands, being common in the Upper Clyde district. Is rare in the East Lowlands and has only been found in a few localities. It is frequent in the hilly district of the East and West Highlands, and is common in many places. In the Inner Hebrides it is uncommon, due perhaps in some measure to the basalt and gabbro of these islands not producing a tenacious detritus by the sides of the streams. Its distribution in the North Highlands is not yet well known, only a few localities being recorded for it. It has not been found in Orkney and is rare in Shetland. This species, being nearly always in moist or wet gravelly detritus at the side of mountain streams and subalpine ravines, is rare or absent in districts where this detritus is not found, such as the more level islands and some parts of the mainland. It is most common in schistose districts, though also found in gneissic and granite formations. It very rarely grows directly on

the rock. Exceptionally it is found in marshes on the hills. Fruit, mature from April to July, is common. Gemmæ are frequent.

Scotch Alps (T. Drummond in Edin. Herb.).

S.W. Lowlands.—*Dumfries:* Drumlanrig (J. Murr.); Euchan W., per. (Macv.); Crawick W. (Macv.). *Kirkcudbright:* Knockmarling Burn, per. (M'And.); Garpol Burn (M'And.); Glenlee Glen (M'And.); L. Brack (G. West); R. Dee, Newton-Stewart (G. West). *Wigtown:* W. of Luce, above New Luce (Ewing).

N.W. Lowlands.—*Ayr:* Beith, per. (Ewing); Darvel, per. (Ewing). *Renfrew:* Loch Thom (Ewing); Glen, Misty Law, per., ♂ (Scott). *Lanark:* Tinto, alt. 1300–1900 ft., R.C. (Macv.); Elvanfoot district, F. (Macv.); Green Lowther, alt. 1700–2100 ft., V.C. (Macv.).

E. Lowlands.—*Peebles:* Talla W. from 900 ft. alt. (Macv.). *Selkirk:* Banks of Yarrow, Bowhill, per. and ♂ (Evans). *Edinburgh:* Nether Habbie's Howe, cfr. (Evans); Crosswood Burn, ♂ (Evans); R. Almond, Craigiehall Bridge, per. (M'And.).

S.E. Highlands.—*Fife and Kinross:* Lomond Hills (Ewing); West Lomond Hill, per. (Evans); Tents Muir, per. and ♂ (Holmes). *S. Perth:* Ben Ledi, per. (Scott); Strathyre (Macv.). *Mid Perth:* Ben Lawers (C. J. Wild *cf.* Pears. Hep. Brit., p. 212); Killin district, C. on the low ground, F. on the hills, ascending to 3300 ft. on Ben Lawers (Macv.); Glenlochy Hills (Young); Ben Heasgarnich, per. (Ewing); Clifton Burn, C., and C. cfr. (Macv.); Achrioch Wood Burn, C., and C. cfr. (Macv.); Tayside, Inver (M'In.); Rumbling Bridge nr. Dunkeld (Holmes); Ben Chuirm (Young); Coire Ardran (Macv.); Am Binnean (Young). *N. Perth:* Glas Thulachan, alt. 3200 ft., 1879 (Ferg.); Glen Tilt (West); Persie (Barker).

Mid E. Highlands.—*Forfar:* Head of Nathro Burn (Ferg.); Camlochan (Ew. and Young); Reeky Linn, cfr. (Aimer); Lundie (J. Fulton). *Kincardine:* Several places, as Invery, Strachan, Blackhall, Blackburn Burn, Brae of Lathers (Sim); Corvie Water (M'And.). *S. Aberdeen:* Ben MacDhui (Whitehead); side of R. Dee, Balmoral, cfr. (Stabl.).

N.E. HIGHLANDS.—*Elgin:* Linn of the Shogle, Elgin, 1848, cfr. (Croall). *E. Inverness:* Lethendry Hill, Carr Bridge, alt. 1000 ft. (Miss Macv.); Glen Tromie, per. (Miss Macv.).

W. HIGHLANDS.—*Kintyre:* Nr. Lochgilphead, per. and ♂ (Ewing). *Dumbarton:* Ben Vorlich, F. (Macv.); Allt Dubh Uisge (Macv.); ravine nr. Arrochar, per., C. (Macv.). *W. Stirling:* Inversnaid (Macv.). *Argyll:* Glencoe, alt. 400 ft., per. (Macv.); Ben Cruachan, alt. 1000 ft. (Macv.); nr. Ballachulish (Macv.); Kentallen, per. (Macv.). *W. Inverness:* Glenfinnan (Carr.); Moidart, F. (Macv.); Sunart, F. (Macv.); shore of Loch Laggan (Miss Macv.); Choir Arder (Ferg.); Ben Nevis to 3600 ft. (Macv.).

INNER HEBRIDES.—*Mid Inner Hebrides:* Dervaig, Mull (Macv.). *N. Inner Hebrides:* Sligachan (Miss Macv.).

OUTER HEBRIDES.—Tarbert (West); Harris, ♂ (Ewing).

LOWER N. HIGHLANDS.—*W. Ross:* Strathcarron, L.C. in ravines (Macv.).

UPPER N. HIGHLANDS.—*E. Sutherland:* Nr. Rogart (Lillie). *W. Sutherland:* Strath Halladale, per. (Lillie). *Caithness:* Langwell Deer Forest (Lillie).

SHETLAND.—Bressay (West).

SCAPANIA BARTLINGII (*Hampe*) *Nees*

This rare species has been found only in one locality in Scotland, among other limestone species.

MID E. HIGHLANDS.—*Forfar:* Rocks at The Burn, foot of Glenesk, *sub nom. Jung. riparia*, with *Haplozia riparia*, *Loph. turbinata*, and *Bleph. trichophyllum*, 1862 (Croall).

SCAPANIA ÆQUILOBA (*Schwægr.*) *Dum.*

A rare species, though frequent on some of the hills in the East Highlands. It is very rare in the Lowlands, having been found only in one locality. Is also very rare in Fife and the low-lying districts of the East Highlands. On several of the hills of Mid and East Perth it is frequent from 1800–3200 ft. alt. It has not been found on the hills near the coast of the West Highlands, and is rare over all that province; in one district it occurs in quantity on grassy

banks on the shore, bordering a sand-dune, the shell sand affording the desired lime. It has not been found in the Hebrides nor in the northern islands, and as yet only in one place in the North Highlands. It appears to be mainly a subalpine and alpine species in Scotland, as it is almost absent from the various low-ground districts in which limestone is found.

When on the hills it forms thin, erect tufts, or occurs as scattered stems among mosses, on moist, shady rock ledges. On the low ground it is generally in shaded ravines. Perianths are rare, and fruit has not been seen; male plants are frequent, and gemmæ are common.

N.W. Lowlands.—*Renfrew:* Cloch (West).

S.E. Highlands.—*Fife and Kinross:* Glen Queich, per. (Evans). *S. Perth:* Tillicoultry Glen, ♂ (Evans). *Mid Perth:* Ben Laoigh, 1883 (Ewing); do., ♂ 1889 (Ewing); do., in a few places from 1700–1900 ft. alt. (Macv.); Ben Dubh Craige, alt. 2200 ft. (Macv.); Carn Creag, ♂, alt. 2700 ft. (Macv.); Craig-an-Lochain, alt. 2300 ft. (Macv.); Ben Lawers, ♂, alt. 3000 ft. and 3200 ft. (Macv.); Achrioch Burn with *Cololej. calcarea* (Macv.); Meal na Saone (Young). *N. Perth:* Lion's Face, Braemar (Stabl.); Coire Ceandor (West).

N.E. Highlands.—*Elgin:* Banks of the Findhorn, Elginshire, 1848 (Croall).

W. Highlands.—*Argyll:* Lismore (Macv.); Glen Nant (Macv.); Ben Doureann (Ew. and Macv.). *W. Inverness:* Moidart, R. (Macv.).

Lower N. Highlands.—*E. Ross:* Fairy Glen, Rosemarkie (Miss Macv.).

Scapania aspera *Bernet*

A rare plant in Scotland, and only found in a few localities. Although it is a rare species in general in the north of Europe, the small amount of lime formation in our country may cause it to be rarer than it would otherwise have been. It is not absolutely confined to soil containing lime, but is almost so. This plant has been found only in the Highland provinces. The typical plant does not occur on the hills, the usual form being what

Herr Müller has named for me with some doubt as *forma brevifolia*. The plant of sand-dunes has the margin of the leaves almost without teeth, and also differs in other points from the type; I have placed it here under the var. *inermis*.

S.E. Highlands.—*S. Perth:* Tillicoultry Glen (Evans). *Mid Perth:* Nr. Killin, 1878 (R.K. in Croall Herb.); Craig Mhor (Ewing); Ben Laoigh (Ewing); do., R. (Macv.); Achrioch Wood, cfr. (Macv.); Clifton Burn (Macv.); Ben Lawers, alt. *ca.* 3000 ft. (J. Hunter).

Mid E. Highlands.—*Forfar:* Braemar, 1856 (Stabl.).

W. Highlands.—*Clyde Isles:* Loch Ranza, ♂, among *Frullania* (Macv.). *Argyll:* Lismore (Macv.). *W. Inverness:* Moidart, v.r. (Macv.).

Outer Hebrides.—Benbecula (West).

Lower N. Highlands.—*W. Ross:* Strome Ferry (Macv.). *E. Ross:* Fairy Glen, Rosemarkie (Miss Macv.).

v. inermis *C. Müll. Frib.*

Upper N. Highlands.—*W. Sutherland:* Balnakil, Durness (Lillie). *Caithness:* Dunnet Links (Lillie); Thurdostoft Links (Lillie).

Scapania gracilis (*Lindb.*) *Kaal.*

S. resupinata Carr.

Widely distributed from Dumfries to Shetland, but only common in the western districts of the Highlands and parts of the North Highlands. It is frequent in several subalpine districts of the West Lowlands, but appears to be absent in the more central parts, as the Upper Clyde valley. Is very rare in the East Lowlands, and only occurs there as a depauperate form, except in one or two well-marked subalpine districts. It is also very rare in Fife and in the eastern part of the East Highlands, with the exception of the Aberdeen Grampians, where it is frequent. Has not been found in East Stirling or in North Perth, and is uncommon in Mid Perth until the western boundary is reached. Over all the West Highlands and the Inner and Outer Hebrides it is very common, being one of the commonest species. It continues common in the western

part of the North Highlands, and rather common in the north mainland, and apparently also frequent on the eastern side. It is common in Orkney and Shetland.

This species is most abundant on the low ground of the Highlands, but is frequent on the hills of the west coast, where it ascends to 2300 ft. alt. It grows in large yellowish-brown patches often 2 feet or more in diameter, on moist rocks and not rarely on wet rocks, also sometimes on rather dry exposed rocks and banks and on dry boulders, and frequently on the lower parts of stems of trees. It is also common as scattered stems among other species on rock ledges on the hills as the var. *laxifolia*. Fruit is common from the end of March to June, and also is found in late autumn. Gemmæ are abundant.

S.W. Lowlands.—*Kirkcudbright:* Criffel, 1840 (Cruicks.); New Galloway (M'And.); Glen Trool, F. (Macv.). *Wigtown:* Knowe, cfr. (Ewing); nr. New Luce (Ewing).

N.W. Lowlands.—*Ayr:* Largs (Ewing); Glen Afton, on wall (Macv.). *Renfrew:* Kelly Glen (Ewing); Inverkip, ♂ (Lee); Glen, Misty Law, per., F. (Scott). *Lanark:* Avon (J. Murr.).

E. Lowlands.—*Peebles:* Talla Water, alt. 1000 ft. (Macv.). *Haddington:* Lammer Law (Evans). *Edinburgh:* Nether Habbie's Howe (Evans). *Linlithgow:* Riccarton Hills (Evans); Dalmeny, shore (M'And.).

S.E. Highlands.—*Fife and Kinross:* Dunearn Hill (Young). *S. Perth:* Aberfoyle (Ewing); Trossachs, many places, also cfr. (Ewing and West); Menstrie Glen (Evans); Strathyre (Macv.). *Mid Perth:* Finlarig Wood and Auchmore, Killin (Macv.); Achrioch Wood, v.c. (Macv.); Ben Laoigh, R. (Macv.); Clifton Burn, R. (Macv.); Am Binnean (Young); Crianlarich (Barker); Coire Ardran (Macv.).

Mid E. Highlands.—*Forfar:* Lochlee, Glenesk, 1861 (Croall). *Kincardine:* Bay of Nigg, 1836 (Dickie); Strachan (Sim); Den of Garol (Sim). *S. Aberdeen:* Glen Muick (Sim); Lochnagar (Sim); Finzean (Sim); Glen Beg, and Lion's Face, Braemar (Stabl.); Balmoral (Stabl.). *N. Aberdeen:* Mormond Hill (Ewing).

N.E. Highlands.—*E. Inverness:* Glengarry (How.); Invercannich, cfr. (Cocks); nr. Fort Augustus, C. (Macv.).

W. Highlands.—*Kintyre:* Several places, as Carradale, Campbeltown, and Tarbert (Ewing); Dunsky Hill and Ronachan (Macrae); nr. Lochgilphead (Ewing). *Clyde Isles:* Corrie (Ewing); Brodick, cfr. (Campb.); Loch Ranza (Campb.); do., c. (Macv.); Bute, cfr. (Ewing). *Dumbarton:* Ben Vorlich (Barker); do., r.c. to 2300 ft. alt. (Macv.); Ardlui, c. (Macv.); Arrochar, c. (Macv.); Tarbert (Macv.). *W. Stirling:* Loch Lomond, 1821 (Grev.); Campsie Glen (Dickie Herb.); do. (Ewing); Rowardennan (M'And.); Inversnaid, r.c. (Macv.). *Argyll:* Kilmun (Wilkie); Lochgoilhead (Ham.); N. of Crinan Canal (West); Glencoe, c. (Macv.); Ballachulish (Macv.); Coire Athoich (A. Murr.); Glen Nant, r.c. (Macv.); Loch Awe district, c. (Macv.); Ben Cruachan, f. (Macv.); Loch Tulla, f. on stumps and banks (Macv.); Kentallen, per., c. (Macv.); Ben Arthur, u. (Macv.). *W. Inverness:* Moidart, v.c. and cfr. c. (Macv.); Ardnamurchan, v.c. (Macv.); Sunart, v.c. (Macv.); Mallaig and Loch Morar, cfr. (West); Coire Dheirg, Glen Nevis, to alt. 1800 ft., c. (Macv.); Ben Nevis (Macv.); Ben Screel (Ewing).

Inner Hebrides.—*S. Inner Hebrides:* Jura, several places (Ewing); Sgor Bhogachain, alt. 1000 ft., and Ardimersay, Islay (Gilm.); Kildalton, etc., Islay (Ewing). *Mid Inner Hebrides:* Ben More, per. (Ewing); Tobermory, Dervaig, etc., per. (Macv.); Salen (Kenn.); Glenforsa (Kenn.); Tiree (Macv.). *N. Inner Hebrides:* Skye, without further locality (Evans); Broadford district, c. (Macv.); Storr Rock (Ewing); Sligachan (Miss Macv.).

Outer Hebrides.—Barra (Ewing); Benbecula (Ewing); Tarbert, many places, per. (West); Clisham (West); Balallan, many places, per. (West); Stornoway (Gibs.); St Kilda (J. Waterston).

Lower N. Highlands.—*W. Ross:* Ben Eay (How.); Strathcarron, v.c. and cfr. c. (Macv.); Strome Ferry, c. (Macv.); Kyle, c. (Macv.); Gairloch (Miss Macv.); Loch Maree (Miss Macv.). *E. Ross:* Achnasheen, per. (Macv.); Loch Luichart, per. (West); Falls of Rogie, per. (M'In.).

Upper N. Highlands.—*E. Sutherland:* Nr. The Mound (Lillie); nr. Rogart, cfr. (Lillie). *W. Sutherland:* Strath Halladale (Lillie); Scourie and Rhiconich (West); Farr (Lillie); between Durness and Tongue (Lillie). *Caithness:*

Many places, as Latheronwheel, Benacheilt, Reisgill Burn, Dunnet Head, Ulbster, and Watten (Lillie).

ORKNEY. — Kirkwall, per. (West); Stromness (West); Shapinsay (Lillie); Stennis (Lillie); Hoy, several places, per. (Lillie).

SHETLAND. — Lerwick (Sim); Yell (Sim); Unst (Sim); Bressay, per. (West); Scalloway, many places (West); Uyea (Beeby); Whalsey, c., and Unst, c. (Lillie).

var. LAXIFOLIA *Carr.*

S.W. LOWLANDS.—*Kirkcudbright:* Glen Trool (Macv.).

E. LOWLANDS. — *Peebles:* Talla Water, alt. 1000 ft. (Macv.).

S.E. HIGHLANDS.—*Mid Perth:* Ben Laoigh (Macv.).

N.E. HIGHLANDS. — *E. Inverness:* Inverfarigaig Pass (G. West).

W. HIGHLANDS.—*Clyde Isles:* Cairn na Cailleach, Arran (Macv.). *Dumbarton:* Ben Vorlich (Macv.).

LOWER N. HIGHLANDS.—*E. Ross:* Achnasheen (Macv.).

UPPER N. HIGHLANDS.—*W. Sutherland:* Ben Laoghal (Lillie).

ORKNEY.—Hoy, several places (Lillie).

var. MINOR *Pears.*

S.W. LOWLANDS. — *Kirkcudbright:* New Galloway (M'And.).

S.E. HIGHLANDS.—*Mid Perth:* Achrioch Wood (Macv.).

MID E. HIGHLANDS.—*Kincardine:* Den of Garol (Sim).

W. HIGHLANDS.—*Kintyre:* Carradale, per., and Tarbert (Ewing). *Dumbarton:* Arrochar (Macv.). *W. Stirling:* Rowardennan (M'And.). *Argyll:* Loch Awe district, c. (Macv.). *W. Inverness:* Glen Nevis (Macv.); Moidart (Macv.).

INNER HEBRIDES.—*S. Inner Hebrides:* Jura (Ewing).

OUTER HEBRIDES.—Tarbert, etc. (West).

ORKNEY.—Hoy, several places (Lillie); Ward Hill, Hoy (Lillie).

SCAPANIA CRASSIRETIS *Bryhn*

This rare alpine species has only been found in one locality on the Breadalbane Hills.

S.E. Highlands.—*Mid Perth:* Ben Heasgarnich, on a wet rock, alt. 2300 ft., July 1900 (Ewing).

Scapania nemorosa (*L.*) *Dum.*

Widely distributed from Dumfries to the North Highlands, but uncommon, and in many districts rare. Rare in general in the West Lowlands, being almost confined to a few of the districts which have a fairly large rainfall and where there is shelter, and it has not been found in the Upper Clyde valley. It is still rarer in the East Lowlands, having been found in very few localities, and in no place frequent. Is rare in Fife, and uncommon throughout the East Highlands. In the West Highlands it is more frequent than elsewhere, but is not common, and in several districts is rather rare. Is very rare in the Inner and Outer Hebrides, and is uncommon on Ross, the latter being the most northerly district in which it has as yet been found. Although most frequent on the west side of the country, this is rather owing to the greater shelter with moisture in that district than to any Atlantic distribution. It does not especially affect such localities as Atlantic species do, and it is found all over the country where suitable conditions are present.

This species forms pale-green, erect tufts on moist banks and among rocks and shady walls, and occasionally on tree stems and fallen logs, in damp places. It is a low-ground plant, and is rarely found above 1000 ft. alt. Fruit, mature from April to July, is common. Gemmæ are common.

The var. *uliginosa* Jensen is widely distributed in marshes from Stirling to West Ross, but is uncommon.

S.W. Lowlands. — *Dumfries:* Crawick Water, cfr. (Macv.); Crichope Linn (Macv.); Euchan Water (Macv.). *Kirkcudbright:* New Galloway (M'And.); Polharran Glen, per. (G. West). *Wigtown:* Nr. New Luce (Ewing); nr Penningham, cfr. (Macv.).

N.W. Lowlands.—*Ayr:* Glen Afton, on bank (Macv.).

E. Lowlands.—*Peebles:* Rachan, on shady wall, v.r. (Macv.). *Selkirk:* Glenkinnon Burn, on shady wall (Macv.). *Edinburgh:* Corstorphine Hill (M'And.). *Linlithgow:* Craigie Hill (Evans).

S.E. Highlands.—*Fife and Kinross:* Otterston Loch, on wood (M'And.) *E. Stirling:* Muiravonside (Evans). *S. Perth:* Runnagona, Aberfoyle (Evans): Trossachs, on wood (Ewing). *Mid Perth:* Inver, on old trees (M'In.); Finlarig Wood (Young). *N. Perth:* Den of King's Seat (Ferg.).

Mid E. Highlands.—*Forfar:* Kirriemuir, per. (Sim); Fern (Ferg.); Lundie (J. Fulton). *Kincardine:* Scolty (Sim). *S. Aberdeen:* Lochnagar (Sim); Glen Beg, Braemar (Stabl.)

N.E. Highlands.—*Elgin:* Glen Beg nr. Grantown (Miss Macv.). *E. Inverness:* Laggantigown nr. Aviemore (Miss Macv.).

W. Highlands.—*Dumbarton:* Nr. Dumbarton, 1841 (Stark); Ardlui (Macv.); Arrochar, per. (Macv.). *W. Stirling:* Rowardennan (M'And.); Inversnaid (Macv.). *Argyll:* Argyllshire, without nearer locality, 1846 (Stark); nr. Loch Awe Station, v.r. (Macv.); Inveraray (Camph.); nr. Ballachulish (Macv.); Kentallen (Macv.); Kilmun Hills, per. (Scott). *W. Inverness:* Moidart, u. (Macv.); Ardnamurchan (Macv.); Sunart (Macv.); Glen Nevis (Macv.).

Inner Hebrides.—*Mid Inner Hebrides:* Tobermory, per. (Macv.).

Outer Hebrides.—Tarbert (West).

Lower N. Highlands.—*W. Ross:* Nr. Loch Maree, 1875 (H. Boswell); do. (Miss Macv.); Strathcarron (Macv.). *E. Ross:* Loch Luichart, per. (West).

var. uliginosa *Jens.*

S.E. Highlands.—*S. Perth:* Wharry Glen (Evans).

Mid E. Highlands.—*Kincardine:* Tillylair (Sim).

W. Highlands.—*Dumbarton:* Arrochar (Macv.). *W. Stirling:* Rowardennan (M'And.). *Argyll:* Foot of Glen Nant (Macv.); Coire Athoich, cfr. (A. Murr.); Loch Awe (Macv.). *W. Inverness:* Moidart, several places (Macv.).

Lower N. Highlands.—*W. Ross:* Strathcarron (Macv.).

Scapania nimbosa *Tayl.*

Very rare, and confined to the western half of Scotland, though it occurs slightly over the western watershed where

this is near the west coast. It has been found in greatest quantity on the Ben Nevis range of hills.

Occurs as erect, scattered stems or thin reddish to yellowish-brown tufts on moist rock ledges among mosses, and is often accompanied by *Scap. ornithopodioides*, *Jamesoniella Carringtoni*, *Anastrepta orcadensis*, and *Barbilophozia barbata*. Its range extends from 1500–2500 ft. alt. No inflorescence or gemmæ have been seen.

S.E. Highlands.—*Mid Perth:* Ben Laoigh, alt. *ca.* 1700 ft., July 1895 (J. Murr.).

W. Highlands.—*W. Inverness:* Sgùir Donald, Moidart, on rocky banks, alt. 1700 ft., 1898 (Macv.); Coire nam Feusgam, Glen Nevis, alt. *ca.* 2500 ft. (W. E. Nicholson); Ben Nevis, alt. 2000 ft. (H. H. Knight).

Lower N. Highlands.—*E. Ross:* Mam Soul, a few stems among mosses near a stream at *ca.* 1500 ft. alt., 1904 (Cocks).

Scapania ornithopodioides (*With.*) *Pears.*

Jung. planifolia Hook.

This large and handsome Atlantic species is frequent on several hills in the West Highlands. It has also been found in the Cairngorm range, but appears to be absent from the hills of Forfar and North Perth. It is very rare in Mid Perth, and only found close to the western boundary. Has also been found in East Ross, but only adjoining the western watershed. It doubtless occurs in West Sutherland. It is found in the Inner Hebrides, but not as yet in the Outer islands nor in Orkney or Shetland. If absent in Shetland, it must be due to the want of suitable localities, as Jensen records it from the Faroe Islands.

The general range of this species is from 1500–2000 ft. alt. It descends to 1000 ft. alt. in Argyll and to 1200 ft. alt. in West Inverness, but such low altitudes are exceptional. It forms large, reddish, thick layers, or occurs scattered among mosses, on moist rock ledges, among boulders, and on grassy slopes when rocky, always in situations which are not exposed to draught.

Neither inflorescence nor gemmæ have been seen.

S.E. Highlands.—*Mid Perth:* Ben Laoigh, with *Mastigo-*

phora Woodsii, *Pleurozia*, *Bazz. tricrenata*, *Leptocyphus Taylori*, from 1400–1800 ft. alt., R. (Macv.); Ben Chuirm (Macv.).

Mid E. Highlands.—*S. Aberdeen:* Ben a Bourd and Ben MacDhui, 1812 (G. Don *cf.* Hook. Brit. Jung., p. 67); Ben MacDhui, with *Anast. Donianum*, 1856 (Croall); do., 1884 (Stabl.); Braemar (Dickie).

N.E. Highlands.—*Banff:* Nr. Loch Avon, 1830 (Grev.).

W. Highlands.—*Dumbarton:* Ben Vorlich, 1842 (Gourlie and C. A. Johns); do., C. from 1800–2000 ft. alt. (Macv.). *Argyll:* Glencoe, alt. 1000 ft. (Macv.). *W. Inverness:* Moidart, several places from 1700–1800 ft. alt. (Macv.); Coire Dheirg, Glen Nevis, alt. 1500–1800 ft. (Macv.); Coire nam Feusgam, Glen Nevis, alt. 2000 ft. (W. E. Nicholson); Ben Nevis (H. H. Knight).

Inner Hebrides.—*S. Inner Hebrides:* Jura (Ewing). *N. Inner Hebrides:* Ben Cailleach, Broadford, F. from 1500–1600 ft. alt. (Macv.).

Lower N. Highlands.—*E. Ross:* Sciur na Lapaich, with *Anast. orcadensis* and *Bazz. tricrenata* (Cocks).

Scapania purpurascens (*Hook.*) *Tayl.*

Generally distributed from Dumfries to Shetland, and common except in the low-lying districts of the Lowlands and the agricultural region of the East Highlands. In the West Lowlands it is frequent, and it is locally common in subalpine districts. In the East Lowlands it is uncommon in the low ground, frequent in some subalpine districts, and common in the Upper Tweed valley. It is frequent in Fife and the low ground of the East Highlands, and is common over all the hilly districts of the Highland provinces and on the islands, being one of the commonest species by the sides of streams and on wet rocks. The most frequent form in the Lowlands, and also frequent over the Highlands, is the var. *ambigua* De Not, an intermediate plant between the type and *S. undulata*, and which in many cases might be placed equally to one or the other. The var. *speciosa* Nees is not rare. *S. purpurascens* forms small tufts on wet rocks, most often by the side of streams, or covers considerable spaces on wet rocks and rocky banks

and on stony, marshy ground; it also sometimes forms large spongy masses in springs and wells on the hills, especially when at a considerable altitude. Its colour is generally some form of reddish-purple, though sometimes dark green. It ascends Ben Nevis to the highest spring at 3600 ft. alt., and in the East Highlands to 3300 ft. alt. at least. The small plant on rocks fruits abundantly from April to July: less frequently, though still not uncommonly, is fruit seen in the larger plant of springs, etc. Fruit may be seen until September. Gemmæ are common.

On the Scotch mountains, abundant (Hook. *cf.* Brit. Jung., p. 21).

S.W. Lowlands.—*Dumfries:* Sanquhar district, L.C. (Macv.); Moffat Water (Johns.); Whitecombe, per. (Johns.). *Kirkcudbright:* New Galloway (M'And.); Merrick (J. Murr.); Corserine (West); Screel Hill (A. Murr.); Criffel (Scott); Penkill Burn and Glen Trool (Macv.). *Wigtown:* Cairnryan (Ewing); Portpatrick (Macv.); Aldouran Glen (Macv.).

N.W. Lowlands.—*Ayr:* Largs (Ewing). *Renfrew:* Lochwinnoch (Ewing); Glen, Misty Law (Scott); Cloch (Ewing). *Lanark:* Bonnington Falls (Young); Elvanfoot, R. (Macv.); Lowther Hills, c. from 1500–3200 ft. (Macv.).

E. Lowlands.—*Peebles:* Cowie's Linn, cfr. (Evans); Medwyn Water (Evans); Fairlie Hope (Evans); Carton Burn, alt. 1200 ft., C. (Macv.); Talla Water, C. (Macv.). *Selkirk:* Bowhill (Evans); St Mary's Loch (Evans). *Roxburgh:* Melrose district, R. (Macv.). *Berwick:* Cockburnspath (M'And.). *Haddington:* Traprain Law (M'And.). *Edinburgh:* Nether Habbie's Howe, cfr. (Evans); Roslin Glen, cfr. (A. Murr.); Hawthornden, cfr. (M'And.); Balerno (M'And.); Arniston Glen (M'And.); Logan Burn (M'And.); Craighall Bridge, per. (M'And.). *Linlithgow:* Carriber Glen, per. (M'And.); Crawhill, per. (Evans).

S.E. Highlands.—*Fife and Kinross:* Golland, cfr. (Ewing); Bishop Hill (Evans); nr. Aberdour (M'And.); West Lomond Hill (Young); Falkland Woods (Evans); Dollar Glen (W. H. Thomson); St Andrews (Macv.). *South Perth:* Ben Ledi, cfr. (Evans); Strathyre, F. (Macv.); Ben Aan, cfr. (West); Aberfoyle, cfr. (Evans); Bencleuch

(Evans). *Mid Perth:* Ben Laoigh, cfr. (Croall); Tyndrum district, R.C. (Macv.); Killin district C. to *ca.* 3300 ft. (Macv.); Ben Heasgarnich (Young); Craig Vinean and Inver Wood (M'In.). *North Perth:* Glenshee district, C. (Ew. and Young).

MID E. HIGHLANDS.—*Forfar:* Camlochan, 1843 (Gard.); do. (Ferg.); Glen Dole, cfr. (Croall); The Burn, Forfar, cfr. (Croall); Ravine of the Mourne, cfr. (Croall); Glen Isla (G. West); Sidlaws (Aimer); Reeky Linn (Aimer); Lochpharrel, cfr. (Aimer); Glenogil, Fern, Noran, etc. (Ferg.). *Kincardine:* Dalfro (Sim); Invery Wood (Sim); Arnhall (Ferg.); Mount Shade (Sim); Stonehaven (M'And.). *S. Aberdeen:* Hill of Fare, 1840 (Dickie); Pennachan Cliffs (Dickie); Ben-na-Bourd, 1844 (Gard.); Braemar, cfr., 1857 (Croall); Lochnagar (Sim); Glen Callater (Ferg.); Ben MacDhui and Glen Beg (Stabl.); Potarch (Sim). *N. Aberdeen:* Mormond Hill (Ewing).

N.E. HIGHLANDS.—*Elgin:* Linn of the Shogle, 1844 (Croall); banks of the Findhorn, cfr. (Croall); Dreggie Burn, per. (Miss Macv.). *E. Inverness:* Cawdor, Nairn, 1844 (Croall); Kingussie (Ferg.); Cairngorm (Macv.); Braeriach (Wheldon); Glen Tromie, per. (Miss Macv.); Laggantigown (Miss Macv.); nr. Carr Bridge (Miss Macv.); Slochd (Miss Macv.); Glen Cannich (Cocks); Mam Soul (Cocks); Fort Augustus, C. (Macv.).

W. HIGHLANDS.—*Kintyre:* West Tarbert (Ewing); nr. Ardrishaig (Ewing). *Clyde Isles:* Goatfell, 1840 (Grev. Herb.); Corrie, Arran (Ewing); Loch Ranza (Macv.); Bute, cfr. (Ewing). *Dumbarton:* Arrochar, C. (Macv.); Tarbert (Macv.); Ardlui, C. (Macv.). *W. Stirling:* Ben Lomond (Ewing); Inversnaid, F. (Macv.); Campsie, cfr. (Ewing). *Argyll:* Puck's Glen (A. Murr.); Sandbank. cfr. (Ewing); Ben Arthur, C. (Macv.); Kentallen (Macv.); Ballachulish (Macv.); Glencoe (Macv.); Loch Tulla (Macv.); Ben Doureann, C. (Ewing and Macv.); Loch Awe, C. (Macv.); Ben Cruachan, C. (Macv.); Glen Nant, R.C. (Macv.). *W. Inverness:* Choir Arder (Ferg.); Ben Nevis to 3600 ft. (Macv.); Glen Nevis, C. (Macv.); Glenfinnan (Macv.); Moidart, C. (Macv.); Sunart, C. (Macv.); Ardnamurchan, C. (Macv.).

INNER HEBRIDES. — *S. Inner Hebrides:* Jura, cfr. (Ewing); Carrick Ford and Ardtalla Glen, Islay, cfr.

(Gilm.); Machrie, Islay (Miss Evans). *Mid Inner Hebrides:* Ben More, Mull (Ewing); Tobermory (Macv.); Allt na Searmoin (Kemn.). *N. Inner Hebrides:* Red Hills, Broadford, c. (Macv.); Mill Burn, Broadford, c. (Macv.); Sligachan (Macv.).

Outer Hebrides.—Barra (Ewing); Tarbert, several places (West); Stornoway, per. (Gibs.); Clisham (West).

Lower N. Highlands.—*W. Ross:* Strathcarron, c. (Macv.); Glasven, c. (Macv.); Gairloch (Miss Macv.); Strome Ferry, c. (Macv.). *E. Ross:* Ben Wyvis (How.); Achnasheen, cfr., c. (Macv.).

Upper N. Highlands.—*E. Sutherland:* Strath Ullie (Lillie); Ben Griam Mohr (Lillie); The Ord nr. Helmsdale (Lillie). *W. Sutherland:* Strath Halladale, several places (Lillie). *Caithness:* Langwell (Lillie); Scottach Hill (Lillie); Ousdale (Lillie).

Orkney.—Hoy, per. (West); Stennis (Lillie).

Shetland.—Lerwick (Sim); do., per. (West); Scalloway (Sim); do., per. (West); Burn of Vallor (Sim); Clousta Voe (Beeby); Tresta (Beeby); Northmaven (Sim); Ronas Hill (Sim); Yell (Sim); Unst (Sim); Loch of Cliff, Unst (Lillie).

Scapania intermedia (*Husnot*) *Pears.*

This appears to be only a form of *S. purpurascens* occurring on drier ground. It occurs also occasionally on fallen logs in shady places. It has been found from Dumfries to Inverness. The typical plant is rare, but many plants have been examined which would be as well placed under this plant as *S. purpurascens*. Fruit is common in spring.

S.W. Lowlands.—*Dumfries:* Penton Linns, 1889 (Scott).

N.W. Lowlands.—*Ayr:* Darvel, per. and ♂ (Ewing).

E. Lowlands.—*Edinburgh:* Bilston Burn, per. (Evans); Hawthornden, per. (Evans); Clubbiedean, per. (M'And.); nr. Currie, per. (Evans); nr. Colinton, per. and ♂ (M'And.); Penicuik Woods (M'And.).

S.E. Highlands.—*Fife and Kinross:* Glen Queich, cfr. (Evans); St Andrews Bay, cfr. (Aimer). *S. Perth:* Trossachs, on wood (Ewing). *Mid Perth:* Finlarig Burn, on a log (Macv.); Finlarig Woods, per. (Ewing).

Mid E. Highlands.—*Forfar:* Reeky Linn, on rock, per. (Aimer).

W. Highlands.—*Dumbarton:* Ardlui, in ravine (Macv.). *W. Inverness:* Moidart, R. (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Jura, 1889 (Ewing); Ardimersay, Islay (Gilm.).

Scapania undulata (*L.*) *Dum.*

Generally distributed from Dumfries to Shetland, but less common than *S. purpurascens*. In both West and East Lowlands it is uncommon on the low-lying ground, and in most districts is rare. In the subalpine districts of these provinces it is more local than *S. purpurascens*, and does not appear to be common in any district, though large masses of it may sometimes be met with. It is uncommon in Fife and in the low-lying districts of the East Highlands, but is frequent in the subalpine region of the Highlands and Islands, and is common in the alpine region. It forms dark-green masses in streams on the low ground and is sometimes submerged. On the hills it is found in similar situations, as well as in large spongy masses in springs and marshy ground. Fruit is common in June, but the plant is frequently sterile.

Some of the records given below may perhaps be better referred to *S. purpurascens*. This applies especially to those of some of the older botanists, whose specimens were examined some years ago when the species name was not limited in this country as at present.

S.W. Lowlands.—*Dumfries:* Moffat (Johns.); Crichope Linn, R. (Macv.); Crawick Water, R. (Macv.). *Kirkcudbright:* Parish of Irongray, 1846 (Cruicks.); New Galloway (M'And.); Carsphairn (West); Loch Grannoch (G. West); Loch Whingean (G. West); Kippford (Ham.). *Wigtown:* Loch Ryan (Ewing); Craigock Burn (Macv.); nr. New Luce (Ewing).

N.W. Lowlands.—*Ayr:* Largs (Ewing); Glen Afton (Macv.). *Renfrew:* Glen, Misty Law (Scott). *Lanark:* Tinto (J. Murr.); Elvanfoot, R. (Macv.); Lowther Hills (Macv.); Cartland Crags, R. (Macv.); Hamilton (J. Murr.).

E. Lowlands.—*Peebles:* Cowie's Linn (Evans): Broughton district, u. (Macv.); Talla Water (Macv.). *Selkirk:* St Mary's Loch (Evans). *Roxburgh:* Melrose district, r. (Macv.). *Haddington:* Ormiston Hall Woods (Evans). *Edinburgh:* Roslin Woods, 1823 (Grev.); nr. Loganlea Reservoir (Evans); Bilston Glen (Evans); nr. Harburn (Evans); Nether Habbie's Howe (Evans); Currie Moor (Evans); Baads (Ewing). *Linlithgow:* Craigiehall Wood (M'And.).

S.E. Highlands.—*Fife and Kinross:* Glen Burn (Evans). *S. Perth:* Strathyre (Macv.); Aberfoyle (Evans); Ben Cleuch (Evans). *Mid Perth:* Ben Lawers, 1842 (Gard.); do., c. to 3300 ft. alt. (Macv.); Killin hills, c. (Macv.); Tyndrum hills, c. (Macv.); Ben Challum (Ewing); Coire Ardran, c. (Macv.); Ben Chonzie (Meld.); Inver Wood (M'In.). *N. Perth:* Glen Beg, Glen Shee (Ferg.); Glas Thalachan (Ewing); Glen Sochaidh (West); Cairnwell (Ewing and Young); Ben Gulabin (Ewing and Young); Dunkeld (M'In.).

Mid E. Highlands.—*Forfar:* Clova, 1844 (Croall); do., 1876 (Ferg.); ravine at foot of Glenesk (Croall); Camlochan (Ewing and Young); Glen Isla (G. West). *Kincardine:* Den of Garol (Sim); Blackness Burn (Sim); Blackhall (Sim); Kerloch (Sim). *S. Aberdeen:* Loch Muick (Dickie); Braemar, 1856 (Croall); Ben MacDhui (Stabl.); Coire Ceanmor (West); Coire na Glasham (West); Lochnagar (Stabl.); Peter's Hill, Birse (Sim).

N.E. Highlands.—*E. Inverness:* Braeriach, 1822 (Grev.); do., 1908 (Wheldon); Coire Schneada, Cairngorm, alt. 3200 ft. (Macv.); nr. Aviemore (Miss Macv.); Kincraig (Miss Macv.); Cawdor Wood, Nairn, 1844 (Croall).

W. Highlands.—*Kintyre:* Port Righ (Ewing). *Clyde Isles:* Goatfell, 1856 (Nichol); Loch Ranza, c. (Macv.). *Dumbarton:* Arrochar (Macv.); Tarbert (Macv.); Ben Vorlich, c. (Macv.). *W. Stirling:* Inversnaid (Macv.). *Argyll:* Puck's Glen (A. Murr.); Ben Arthur, c. (Macv.); Loch Awe (Macv.); Ben Cruachan, c. (Macv.); L. Tulla (Macv.); Ben Doureann, c. (Ewing and Macv.); Lochgoilhead (Ham.). *W. Inverness:* Summit of Ben Nevis (Hook. *cf.* Brit. Jung., p. 22); Ben Nevis to 3600 ft. alt. (Macv.); Glen Nevis (Macv.); Choir Arder, alt. 3600 ft. (Ferg.); Spean Bridge

(Miss Macv.); Glenfinnan (Macv.); Moidart, Sunart, and Ardnamurchan, R.C. (Macv.).

INNER HEBRIDES.—*S. Inner Hebrides:* Jura (Ewing); Dunadd, Islay (Gilm.). *Mid Inner Hebrides:* Ben More (Ewing); Tobermory (Macv.). *N. Inner Hebrides:* Mill Burn, Broadford, R.C. (Macv.); Red Hills, R.C. (Macv.); roadside to Sligachan, C. (Macv.).

OUTER HEBRIDES.—Barra (Ewing); Tarbert (West); Clisham (West); Stornoway, cfr. (Gibs.).

LOWER N. HIGHLANDS.—*W. Ross:* Slioch, 1867 (How.); Glasven, R.C. (Macv.); Strathcarron, V. (Macv.); Gairloch (Miss Macv.). *E. Ross:* Ben Wyvis, 1864 (How.); Achnasheen, cfr., F. (Macv.).

UPPER N. HIGHLANDS.—*E. Sutherland:* Allt na Muick (Lillie). *W. Sutherland:* Strath Halladale (Lillie); Ben Clibreck (Lillie). *Caithness:* Acharole, Watten (Lillie).

ORKNEY.—Segal Burn, Hoy (Lillie); Trowie Glen, Hoy (Lillie).

SHETLAND.—Unst (Sim); South Clousta Voe (Grieve); Clousta Voe (Beeby); Lerwick (West); Tresta (Beeby).

SCAPANIA OBLIQUA (*Arnell*) *Schiffn.*

The distribution of this species is not yet well known. It is rare, but has been found on several hills both in the East and West Highlands from 1200–3600 ft. alt. It forms large swelling masses of a dark-green colour in wet ground, especially in streamlets and springs.

S.E. HIGHLANDS.—*Mid Perth:* Ben Lawers, alt. 2700 ft. (Macv.); Meal Tarmachan (Evans and W. E. Evans).

N.E. HIGHLANDS.—*E. Inverness:* Braeriach, alt. 2200 ft. (Wilson and Wheldon).

W. HIGHLANDS.—*Dumbarton:* Ben Vorlich, July 1901 (Macv.). *Argyll:* Ben Cruachan, alt. 1200 ft. (Macv.); Ben Doureann (Ew. and Macv.); Ben Arthur, alt. 1900 ft. (Macv.). *W. Inverness:* Roshven, Moidart, alt. 2500 ft., 1900 (Macv.); Ben Nevis, alt. 3600 ft. (Macv.).

SCAPANIA ULIGINOSA (*Swartz*) *Dum.*

Frequent on many of the hills of the East and West Highlands, and occasionally occurring in quantity. It was

recorded many years ago by Dr Nichol for the Dumfriesshire hills, but as the species has been frequently confused with *S. undulata*, it is advisable that the plant be gathered again before considering it as having been found in the Lowland provinces. The Kirkcudbright specimen under this name is *S. undulata*. Besides the East and West Highlands, the plant is also found in the Inner Hebrides, but not yet in the Outer islands. It has not been found in the North Highlands, though it doubtless occurs there. It might be expected to occur in Shetland, but if so, it must be rare.

This species rarely descends below 2000 ft. alt. in the East Highlands, or below 1800 ft. alt. in the West Highlands. It ascends to 3200 ft. alt. in the former, and to 3600 ft. alt. on Ben Nevis. In the island of Skye it descends to 900 ft. alt. Grows in large dark-purple, or occasionally dark-green, spongy tufts in rills and stony, marshy ground. Perianths, which are often imperfectly developed, are common. Fruit, which is uncommon, is mature from June to August.

S.E. Highlands.—*Mid Perth:* Ben Lawers, 1880 (West); Killin Hills, u., ascending to 3200 ft. alt. (Macv.); Ben Laoigh, r.c. from 2300–2500 ft. alt. (Macv.); Ben Dubh Craige, c. from 2100–2600 ft. alt. (Macv.); Coire Ardran, 2100 ft. alt. (Macv.); Ben Odhar, alt. 2000 ft. (Macv.). *N. Perth:* Glen Thulachan (Ewing); Ben Gulabin (Ew. and Young).

Mid E. Highlands.—*Forfar:* Camlochan (Ew. and Young); Glen Dole (Aimer). *S. Aberdeen:* Ben MacDhui, 1873 (Ferg.); Glen Beg, Braemar (Stabl.); Coire Ceandor, with *Haplozia cordifolia* (West).

N.E. Highlands.—*E. Inverness:* Braeriach, alt. 3200 ft. (A. Wilson and J. A. Wheldon).

W. Highlands.—*Argyll:* Ben Cruachan, alt. 1200 ft. (Macv.); Ben Doureann (Ewing and Macv.). *W. Inverness:* Ben Nevis, 1875 (Whitehead); do., to 3600 ft. alt., cfr. (Macv.); Coire Dheirg, Glen Nevis, alt. 2200 ft. (Macv.); Moidart, f. on the hills (Macv.).

Inner Hebrides.—*Mid Inner Hebrides:* Ben More (Ewing). *N. Inner Hebrides:* Ben Cailleach, Broadford, c. in a stream from 900–1400 ft. alt. (Macv.).

Scapania paludosa *C. Müll. Frib.*

Rare, and only as yet found in the centre and east of Scotland. It is an alpine species, ascending to 3200 ft. alt.; its lower limits have not been recorded. It occurs in large grass-green or yellow-green masses in marshy ground, and is noticeable for its very flaccid leaves and strongly arched keel.

S.E. Highlands.—*Mid Perth:* Schiehallion, 1882 (Carr.).

Mid E. Highlands.—*Forfar:* Clova, 1876 (Ferg.): Camlochan, 1904 (Ew. and Young). *S. Aberdeen:* Braemar, 1856 (Croall).

Lower N. Highlands.—*E. Ross:* Ben Wyvis, 1872 (Barker); Scuir na Lapaich, alt. *ca.* 3000 ft., 1904 (Cocks).

var. vogesiaca *C. Müll.*

Mid E. Highlands.—*Forfar:* Camlochan, 1904 (Ew. and Young).

Scapania irrigua (*Nees*) *Dum.*

Generally distributed from Dumfries to Shetland, but rather an uncommon species. It is uncommon to rare in the West Lowlands, being rare in the Upper Nith valley and uncommon in the Upper Clyde district. Is frequent in some parts of the East Lowlands, but not generally so, and is rare in the Upper Tweed district. In the East Highlands it is frequent, and is also frequent in some parts of the West Highlands and Hebrides, apparently continuing so through the North Highlands to Shetland. Its distribution is rendered difficult to learn by the local tendency which it appears to have, in some districts being frequent, and in others under apparently the same conditions being rare or absent.

It is, on the whole, probably more frequent on the east than on the west side of the country, and it is more frequent in the north than in the south. It is, however, uncommon on the hills, though ascending to 3200 ft. alt. in Mid Perth.

Grows in yellowish-green tufts of rather small size in wet grassy ground, marshes, peat-mosses, ditch-sides, and sides of mountain rills. What is probably also a form of

this species occurs on rock ledges among other species on the Killin hills. Perianths are frequent, but fruit is rare. Male plants are common, as are also gemmæ.

S.W. Lowlands.—*Dumfries:* Lochar Moss, 1841 (Gray); Moffat (Miss Macv.); Sanquhar Moss, v.r. (Macv.). *Kirkcudbright:* Barend Moss (M'And.) *Wigtown:* Knowe (Ewing).

N.W. Lowlands.—*Ayr:* Near Ladyland (Scott). *Lanark:* Tinto, alt. 900–1000 ft. (Macv.); Elvanfoot, u. (Macv.); Leadhills (Macv.).

E. Lowlands.—*Peebles:* Logan Water, alt. 1200 ft. (Macv.). *Selkirk:* Nr. Selkirk, ♂ (Evans). *Roxburgh:* Bowden roadside, Melrose (Macv.). *Berwick:* Nr. Seenes Law (Evans). *Haddington:* Salton Wood (Evans). *Edinburgh:* Middleton, 1878 (R. Renton); Corstorphine Hill (A. Murr.); Balerno Moss, c. (Macv.); do., ♂ (Evans); Auchendinny (M'And.); Duddingston (M'And.); Allermuir Burn (Evans); Currie Burn (Evans); Loganlee (Evans); Clubbiedean (M'And.); Logan Burn, ♂ (M'And.). *Linlithgow:* Drumshoreland (Evans); nr. Bathgate, ♂ (Evans); road to Cocklerue Hill (M'And.).

S.E. Highlands.—*Fife and Kinross:* West Lomond Hill, side of rill, per. (Evans); do., on boggy ground (Evans); Tents Muir, ♂ (J. Fulton); roadside, Pouring Den, ♂ (Young). *E. Stirling:* Ridgehead Moss, ♂ (Evans). *S. Perth:* Tillicoultry Glen (Evans). *Mid Perth:* Killin district, r.c. (Macv.); Ben Laoigh, alt. 2200 ft. (Macv.); Coire Ardran, 2000 ft. (Macv.). *N. Perth:* Stormontfield (Meld.); Lorrenty Burn, 1897 (Ferg.); Ben Gulabin (Ew. and Young).

Mid E. Highlands.—*Forfar:* Monikie (Ferg.); Camlochan (Ew. and Young); Craig Owl, on stump (Aimer); Rocky Linn (Aimer). *Kincardine:* Strachan (Sim); Scolty (Sim); Stonehaven, per. (M'And.). *S. Aberdeen:* Braemar, 1857 (Croall); Lochnagar (Stabl.). *N. Aberdeen:* Mormond Hill (Ewing).

N.E. Highlands.—*Elgin:* Glen Beg nr. Grantown (Miss Macv.); Dreggie Burn (Miss Macv.). *E. Inverness:* Aviemore district, several places, also ♂ (Macv.); Carr Bridge (Miss Macv.).

W. Highlands. — *Kintyre:* Campbeltown (Ewing); Southend, ♂ (Ewing). *Clyde Isles:* Corrie (Ewing); Loch Ranza, ditch-sides, R. (Macv.). *Dumbarton:* Milngavie, ♂ 1887 (Ewing); Ardlui (Macv.); Loch Humphrey (Ewing). *W. Stirling:* Inch Cailleach, ♂ (K. & S.). *Argyll:* Head of Loch Awe, in peat-moss (Macv.); Ben an Dothaidh (Ewing and Macv.); Glen Lochy (Macv.). *W. Inverness:* Moidart, F. (Macv.); Morar (West).

Inner Hebrides.—*S. Inner Hebrides:* Ardbeg, Islay (Gilm.); Machrie, Islay, per. and ♂ (Miss Evans). *Mid Inner Hebrides:* Nr. Tobermory (Macv.). *N. Inner Hebrides:* Peat-moss and wet grassy ground nr. Broadford, F. (Macv.).

Outer Hebrides.—Nr. Tarbert, ♂ (West).

Lower N. Highlands.—*W. Ross:* Strathcarron, R.C. (Macv.). *E. Ross:* Achnasheen (Macv.); Fairy Glen, Rosemarkie (Miss Macv.).

Upper N. Highlands.—*E. Sutherland:* Nr. Rimisdale (Lillie). *W. Sutherland:* Hope Bridge (Lillie). *Caithness:* East Watten Moss (Lillie); North Watten Moss (Lillie); The Glebe, Watten (Lillie).

Orkney.—Kirkwall (West).

Shetland.—Lerwick (West); Bressay (West); Fair Isle, per. (Miss Skene).

Scapania rosacea (*Corda*) *Dum.*

Rare but widely distributed. Usually confined to the hills, but also is found on the lower ground in subalpine localities. It is found on moist banks and wet rock ledges, and ascends to 3200 ft. alt. in the East Highlands. Perianths and male plants are common, usually in separate tufts. This plant appears to be only a variety of *S. curta.*

S.W. Lowlands.—*Dumfries:* Sanquhar Hill (Macv.). *Kirkcudbright:* Bennan Hill (M'And.).

S.E. Highlands.—*S. Perth:* Summit of Bencleuch, alt. 2300 ft. (Evans). *Mid Perth:* Craig Chailleach (Young); Killin hills, ascending to alt. 2800 ft., R. (Macv.).

Mid E. Highlands.—*Forfar:* Clova, 1876 (Ferg.). *Kincardine:* Kerloch (Sim). *S. Aberdeen:* Balmoral (Stabl.).

N.E. Highlands.—*E. Inverness:* Coire Schneada, Cairn Gorm, alt. 3200 ft. (Macv.).

W. Highlands.—*Argyll:* Glencoe, alt. 1100 ft. (Macv.). *W. Inverness:* Moidart, R. (Macv.); Sunart, R. (Macv.).

Upper N. Highlands.—*W. Sutherland:* Ben Clibreck, above 2000 ft. alt. (Lillie). *Caithness:* Morven (Lillie).

Scapania curta (*Mart.*) *Dum.*

Generally distributed from Dumfries to Shetland, and is frequent on the east side of the country, but uncommon in the west. It is uncommon in the West Lowlands generally, though rather common in the Upper Clyde district. Is frequent in the East Lowlands, but uncommon in some districts. It appears to be generally found throughout the East Highlands, becoming uncommon near its western boundary. Over the West Highlands it is uncommon and in many places rare, and is rare in the Inner and Outer Hebrides. It appears to be frequent in the North Highlands, and has been found in several places both in Orkney and Shetland. Being an inconspicuous species, it may be sometimes overlooked. It usually occurs in small quantities, and mixed with *Diplophyllum albicans*, *Haplozia crenulata*, or *Ceph. bicuspidata* on loamy banks, more rarely peaty banks, and on ditch-sides on the low ground. It ascends to 2900 ft. alt. in Mid Perth, but is rare on the hills. Perianths are rather uncommon; the male plant is more frequent. I have only one record of fruit being found. Gemmæ are common.

S.W. Lowlands. — *Dumfries:* Langholm (Ewing); Sanquhar Hill, R. (Macv.); Crichope Linn, on rotten wood (Macv.). *Kirkcudbright:* New Galloway (M'And.). *Wigtown:* Knowe (Ewing); Aldouran Glen, ♂ (Macv.); nr. New Luce (Ewing).

N.W. Lowlands.—*Ayr:* Largs (Ewing); Fairlie (Ewing); Glen Afton (Macv.). *Renfrew:* Loch Thom (Ewing); Cloch (Macv.). *Lanark:* Falls of Clyde, ♂ (Young); Carstairs Moss, ditch-side (Macv.); Elvanfoot district, on banks, C. (Macv.).

E. Lowlands.—*Peebles:* Broughton district, U. (Macv.);

Upper Tweed valley, on banks (Macv.). *Selkirk:* Tushielaw (Evans); Glenkinmon Burn (Macv.); Galashiels (Macv.). *Roxburgh:* Melrose district, v. (Macv.). *Berwick:* Longformacus (Miss Macv.); Cockburnspath (M'And.). *Haddington:* Ormiston Hall Woods (Evans); Gullane, per. and ♂ (M'And.); Garleton Hill (Evans). *Edinburgh:* Roslin (Grev.); Balerno Moss (Macv.); Dalmahoy Rocks (M'And.); Corstorphine Hill, per. (M'And.); nr. Swanston, per. (Evans); Glencorse, per. (M'And.); nr. Penicuik (Evans). *Linlithgow:* Riccarton Hills (Evans); Dalmeny (M'And.).

S.E. Highlands.—*Fife and Kinross:* Glen Burn, on old wall, per. (Evans); West Lomond Hill (Young); Humbie Wood (M'And.); St Andrews (Macv.). *E. Stirling:* Nr. Stirling, cfr., 1831 (Greville *cf.* Carr. Brit. Hep., p. 87). *S. Perth:* Trossachs (Cruickshank *cf.* Carr. Brit. Hep., p. 87); Doune (Ewing); Strathyre (Macv.); Trossachs, on wood (Ewing); Bencleuch, per. (Evans). *Mid Perth:* Kiltyrie, Killin, on turf wall, per. (Macv.); Craig-an-Lochain (Ewing); Ben Odhar, alt. 2900 ft. (Macv.). *N. Perth:* Glen Beg, Glen Shee (Ferg.); Glen Tilt (Ferg.).

Mid E. Highlands.—*Forfar:* Forfar Burn, 1862 (Croall *cf.* Carr. Brit. Hep., p. 87); Auchlossie (Ferg.); Monikie (Ferg.); Leytack (Ferg.). *Kincardine:* Scolty, per. (Sim); Blackhall (Sim); Stonehaven (M'And.). *S. Aberdeen:* Ben MacDhui (A. O. Black *cf.* Carr. Brit. Hep., p. 87); Lochnagar (Sim); Coire Ceandor, per. (West); do. (Ew. and Young).

N.E. Highlands.—*E. Inverness:* Mam Soul (Cocks); Nethy Bridge (Miss Macv.); Loch Vaa, per. (do.); Carr Bridge; Lethendry Hill; Boat of Garten; Kincraig, on stumps, per. (do.).

W. Highlands.—*Clyde Isles:* Loch Ranza, ♂, r. (Macv.). *Dumbarton:* Helensburgh, ♂ (Ewing); Arrochar (Macv.). *Argyll:* Nr. Loch Awe Station (Macv.); Lochan Bhe, roadside ditch (Macv.); nr. Ballachulish (Macv.); Loch Tulla, r. (Macv.); Ben Doureann, alt. 2400 ft. (Ewing and Macv.). *W. Inverness:* Moidart, u. (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Jura (Ewing). *Mid Inner Hebrides:* Tobermory (Macv.).

Outer Hebrides.—Middle of N. Uist (West); Tarbert (West).

Lower N. Highlands.—*W. Ross:* Strathcarron (Macv.);

Gairloch (Miss Macv.): Loch Maree (Miss Macv.). *E. Ross:* Achnasheen (Macv.).

Upper N. Highlands.—*E. Sutherland:* Strath Ullie (Lillie). *W. Sutherland:* Strath Halladale (Lillie); Strath Naver (Lillie). *Caithness:* Watten (Lillie); Ousdale (Lillie).

Orkney.—Hoy (West); Stromness (West); Eday (Lillie).

Shetland.—Lerwick (Sim); Northmaven (Sim); Yell (Sim); Clousta (Grieve).

Scapania umbosa (*Schrad.*) *Dum.*

Widely distributed from Dumfries to Shetland. Rare in the drier districts, and occurring there only in moist, sheltered glens; frequent in the wetter districts, and occurring in these localities also in rather exposed peaty ground. It is generally rare in the West Lowlands, but is found in some quantity in a few glens in the low districts, and it has not been found in the Upper Clyde district. Is rare throughout the East Lowlands, and confined to shady glens when in the low-lying parts, but is found on moist peaty banks in the subalpine region. Throughout the East and West Highlands it is found wherever there are moist, shady woods or wooded banks. It has not been yet found in the Inner Hebrides, though it doubtless occurs. In exposed districts, as the Outer Hebrides, the extreme north of the North Highlands, and in Orkney and Shetland, this species is found on moist peaty banks which are partially sheltered by the neighbouring rocks and by the larger surrounding vegetation, but is uncommon. It is a low-ground species, and ascends to 1200 ft. alt. in the Lowlands. Grows most commonly on decaying logs in moist, sheltered ground, often with *Nowellia curvifolia*, occasionally on stumps and frequently on half-buried rocks in woods, in company with *Ceph. bicuspidata*. When in sheltered glens it is also sometimes found on sandstone rocks. On moist peaty banks it is frequently accompanied by *Lepidozia setacea* or *L. trichoclados*, and *Lophozia ventricosa*. Grows in pale-green or reddish patches. Perianths and male plants are usually present; fruit is rather common from March to May.

S.W. Lowlands.—*Dumfries:* Moffat, on log with *Nowellia curvifolia*, per. (M'And.); Euchan W. and Crawick

W., on rocks (Macv.); Crichope Linn, on logs, F. (Macv.). *Kirkcudbright:* New Galloway, on log (M'And.). *Wigtown:* Nr. New Luce (Ewing).

E. LOWLANDS.—*Peebles:* Cowie's Linn (M'And.); Carton Burn, on peat banks, alt. 900 ft. and 1200 ft. (Macv.). *Berwick:* Nr. Seenes Law, on banks of stream (Evans). *Edinburgh:* Glencorse Woods (Evans); Hawthornden (M'And.); Dalkeith Park, on damp sandstone (Evans); Newbattle Abbey, on damp sandstone (Evans). *Linlithgow:* Nr. Bathgate (Evans).

S.E. HIGHLANDS.—*Fife and Kinross:* Kinghorn, per. and ♂ (M'And.); Glen Burn, on sandstone rocks, per. (Evans); Kiels Den (M'And.). *S. Perth:* Strathyre (Macv.); Trossachs, several places, mostly on old wood, also per. (Ewing). *Mid Perth:* Finlarig Wood, on logs, R.C. (Macv.); Kiltyrie (Macv.); Achrioch Wood, on stumps, R. (Macv.); Wood, Am Binnean (Young); Dupplin Woods, on wood (Meld.). *N. Perth:* Den of Reichip nr. Dunkeld (Hook. *cf.* Brit. Jung., p. 24); nr. Spittal of Glen Shee, 1879 (Barker); Glas Thulachan (Ewing).

MID E. HIGHLANDS.—*Forfar:* Noran Falls, on wood (Ferg.); Fern, on wood (Ferg.); Deer Hill Wood (J. Fulton). *Kincardine:* Several places, as Scolty, per., Kerloch, Blackhall, Cairns Mount, Drumtochty (Sim). *S. Aberdeen:* Nr. Ballater, 1840 (Dickie); Lochnagar (Sim); Ballochbuie Forest, on decaying wood (Stabl.); Balmoral, on granite, and on decaying wood (Michie); Coire Ceandor, on wood, with *Bleph. trichophyllum* (Ewing). *N. Aberdeen:* Mormond Hill, on soil (Ewing). *E. Inverness:* Carr Bridge, on fir stump (Miss Macv.); do., on peat-moss (Miss Macv.).

W. HIGHLANDS.—*Kintyre:* Campbeltown (Ewing). *Clyde Isles:* Loch Ranza, F. (Macv.). *Dumbarton:* Tarbert (Macv.); Arrochar, U. (Macv.). *W. Stirling:* Campsie (Ewing); Inversnaid (Macv.). *Argyll:* Nr. Ballachulish (Macv.); Loch Tulla, F. on stumps and banks in old fir-wood (Macv.). *W. Inverness:* Ben Nevis (Hook. *cf.* Brit. Jung., p. 24); Choir Arder (Barker); Moidart, C. on logs, stumps, and half-buried rocks (Macv.); Ardnamurchan, R.C. (Macv.); Sunart, R.C. (Macv.); Coire Dheirg, Glen Nevis, on log (Macv.).

Outer Hebrides.—Barra (Ewing); Tarbert (West).

Lower N. Highlands.—*W. Ross:* Strathcarron, on logs and on turfy banks, R. (Macv.). *E. Ross:* Loch Luichart, per. (West).

Upper N. Highlands.—*E. Sutherland:* Ben Griam Mohr, on the ground (Lillie). *W. Sutherland:* Ben Clibreck, on banks with *Lepidozia setacea* (Lillie); between Durness and Tongue, on soil, per. (Lillie); Hope Bridge, on soil (Lillie). *Caithness:* Dorrery (Lillie); Langwell Deer Forest (Lillie); Achorn Burn (Lillie); Ousdale (Lillie).

Orkney.—Stromness (West).

Shetland.—Yell, with *Scap. gracilis* (Sim); Loch of Girlsta, Nesting, on peat (Beeby).

RADULA Dum.

Radula voluta *Tayl.*

This rare Atlantic species has only been found in one locality, in a ravine.

N.W. Lowlands.—*Ayr:* Ness Glen, 1888, with *Metz. conjugata* and *Lej. patens* (M'And.).

Radula aquilegia *Tayl.*

This Atlantic species is widely distributed on the west side of the country from Kirkcudbright to the North Highlands, and extends to Shetland. It is nearly always close to the coast, but is found inland in a few localities. It is rare everywhere except in West Inverness, where it is common in many ravines near the coast. Only one locality, so far, has been found where it occurs in the West Lowlands, and this is some distance inland. It is found in many parts of the West Highlands and in the Inner Hebrides, and is usually only in small quantity. It has not yet been detected in the Outer Hebrides. In the North Highlands there is only one locality in which it has been found at present, and one in Shetland. As it is usually found in sheltered ravines, it is rare or absent in

the exposed islands. In most districts this species is only found on wet rocks in very sheltered ravines, but in West Inverness it is also found on trees in similar places. It is also not rare in that district on wet rocks on the shore, just above tide-mark. It grows in large reddish-brown patches without mixture as a rule, though frequently the small *Lejeunea* are to be seen creeping over it. When on trees it is of a lighter colour, and is then often in mixture with mosses. Perianths are rather rare when the plant is on rocks, but they are common when it is on trees, and fruit is also then frequent. The months in which mature fruit has been found are May, August, and November.

S.W. Lowlands.—*Kirkcudbright:* New Galloway, 1894 (M'And.).

W. Highlands.—*Clyde Isles:* Loch Ranza, on wet rock, v.r. (Macv.). *Dumbarton:* Loch Garavalt, Glenfalloch (Scott). *W. Stirling:* Inversnaid, r. (Macv.). *Argyll:* Coire Athoich (A. Murr.); Puck's Glen, Benmore (A. Murr.); Glen Nant, r. (Macv.); nr. Loch Awe Station in two ravines (Macv.); Kentallen, r. (Macv.). *W. Inverness:* Moidart, rocks and trees, c. (Macv.); Salen Burn, Ardnamurchan, on rocks (Macv.); Resipol Burn, rocks and trees, c., also cfr. (Macv.).

Inner Hebrides.—*Mid Inner Hebrides:* Allt na Searmoin (Kenn.). *N. Inner Hebrides:* Mill Burn, Broadford, on wet rocks, r. (Macv.).

Lower N. Highlands.—*W. Ross:* Allt Clachan ravine, Strathcarron, on wet rocks, r. (Macv.).

Shetland.—Outskerries (Lillie).

Radula Carringtonii *Jack*

Has been found only in one locality in Moidart, West Inverness, on a wet rock in a ravine close to the shore. It forms thin reddish-brown patches.

W. Highlands.—*W. Inverness:* Moidart, on wet rocks in ravine, v.r., 1898 (Macv.).

Radula Lindbergii *Gottsche*

Widely distributed from Dumfries to Orkney, but uncommon and frequently rare. Rare in the West Lowlands,

and almost confined to subalpine ravines. Has not been found in the East Lowlands. It is rare in Fife and the neighbourhood of the coast in the East Highlands, but is sometimes frequent in the more central districts; its distribution in this province is not well known, as it has been confused with *R. complanata*. Is frequent in many parts of the West Highlands in ravines, but rare in the Inner Hebrides, and it has not been found in the Outer islands. In the North Highlands it is at least uncommon, and is probably rare.

The plant of the low ground forms dirty green or yellowish-green patches on wet rocks, generally in ravines; sterile female inflorescence is usually present in quantity in this form; perianths are uncommon, and the male plant has not been seen. When on the hills the plant is generally as the form *germana*, and often forms compact patches. This form is frequent on the mountains of the East Highlands, and ascends to 3900 ft. alt., but is rare on those of the West Highlands. The male plant is very rare and is confined to the hills. Fruit has not been seen.

S.W. Lowlands. — *Dumfries:* Crawick Water, v.r. (Macv.). *Kirkcudbright:* Darsalloch Burn, ♂ (M'And.); Knockmarling Burn (M'And.).

N.W. Lowlands.—*Renfrew:* Glen, Misty Law (Scott). *Lanark:* Cartland Crags (Macv.).

S.E. Highlands.—*Fife and Kinross:* Raith (Young). *S. Perth:* Alva Glen, 1874 (Croall); Trossachs (Ewing). *Mid Perth:* West Tarmachan, 1880 (Holt and Wild); Ben Lawers, ♂ (Ewing); Killin Hills, in several places (Macv.); Ben Heasgarnich (Ewing); Ben Laoigh (Macv.); Achrioch Burn (Macv.). *N. Perth:* Glen Beg, Glen Shee, 1879 (Barker); Glen Thaitneich (Ewing and Young).

Mid E. Highlands.—*Forfar:* Camlochan (Ewing and Young). *S. Aberdeen:* Braemar (Croall *cf.* Pears. Hep. Brit., p. 68); Glen Beg, Braemar (Stabl.); Glen Beg, Balmoral (Stabl.); Coire Ceanmor (West).

W. Highlands.—*Kintyre:* Clachan (Macrae). *Clyde Isles:* Loch Ranza, v.r. (Macv.). *W. Stirling:* Inversnaid (Macv.). *Argyll:* Glen Nant (Macv.); Falls of Cruachan (Macv.); Ben Dourcann, f., 1200 and 1800 ft. alt. (Ewing

and Macv.); Kentallen, R. (Macv.). W. *Inverness:* Moidart, F. in ravines on the low ground, ♂ plant at 2300 ft. alt. (Macv.); Coire Dheirg, Glen Nevis, 1800 ft. alt. (Macv.); Ardnamurchan (Macv.); Sunart (Macv.).

Inner Hebrides.—*Mid Inner Hebrides:* Tobermory, R. (Macv.).

Lower N. Highlands.—W. *Ross:* Ben Liath Mohr, 800 ft. alt. (Macv.).

Upper N. Highlands.—*Caithness:* Dunbeath Strath (Lillie).

Orkney.—Quoyawa, Hoy (Lillie).

var. germana (*Jack*)

S.E. Highlands.—*Mid Perth:* Ben Lawers (G. E. Davies *cf.* Pears. Hep. Brit., p. 72); Killin Hills, F. to 3900 ft. alt. (Macv.); Ben Heasgarnich (Ewing); Am Binnean (Young); Ben Laoigh (Macv.).

Mid E. Highlands.—*Forfar:* Clova, ♂ (Ferg.); Loch Brandy (Aimer).

W. Highlands.—*Dumbarton:* Ben Vorlich, alt. 2000 ft. (Macv.). *Argyll:* Ben Cruachan (T. Rogers *cf.* Pears. Hep. Brit., p. 72).

Radula complanata (*L.*) *Dum.*

Generally distributed on the mainland and the more sheltered islands, being frequent in most counties and common in some. It is rather uncommon in the agricultural regions of the Lowlands, and rare in the subalpine region, but it is present in most shady glens and moist deciduous woods. In woods on drier ground and on isolated trees in exposed ground it is absent or very rare. This applies also to Fife and to the regions of small rainfall in the East Highlands. In the more central and wetter districts of the province it is common in the low-lying districts. Throughout the low parts of the West Highlands it is generally common, and it is frequent in the sheltered parts of the Inner Hebrides. In the exposed Outer Hebrides it is rare. It becomes less common in the North Highlands, is rare in Orkney, and has not been found in Shetland. As its principal habitat is on trees, it is generally only to be found

where these occur, and usually only in moist and somewhat sheltered localities. It is also not rarely on rocks, but nearly always only when these are sheltered and are in damp places. In open Highland glens, although with trees at the foot, it is rare, and frequently is absent. On the hills it is very rare, but has been found up to 2000 ft. alt. in Mid Perth.

Fruit is very common when the plant occurs on trees, but is rather uncommon when on rocks. It is found mature in all the months, but is most common from March to June. Gemmæ are common, and frequently are present on plants with fruit.

S.W. Lowlands.—*Dumfries:* Moffat (Miss Macv.); Crawick Woods, v.r. (Macv.). *Kirkcudbright:* New Galloway, cfr. (M'And.). *Wigtown:* Knowe, cfr. (Ewing); Dunsky Glen, cfr., v.r. (Macv.).

N.W. Lowlands.—*Ayr:* Largs (J. Murr.). *Renfrew:* Cloch, cfr. (West); nr. Loch Thom, cfr. (West). *Lanark:* Calder, Blantyre (Ewing); Avon, cfr. (J. Murr.); Falls of Clyde, cfr. (Ewing); Cartland Crags, r. (Macv.); Elvanfoot, u. (Macv.).

E. Lowlands.—*Peebles:* Lamancha (Evans); Broughton Burn, u. (Macv.). *Selkirk:* Howden (Evans); nr. Selkirk (Evans); Faldonside, cfr. (Macv.); Caddonfoot (Macv.). *Roxburgh:* Nr. Melrose, cfr. (Renton); do., on trees in deans, u. (Macv.); Hawick, cfr. (Macv.); Kelso (Scott). *Berwick:* Pease Dean, v.c. (Macv.); Longformacus (Miss Macv.). *Haddington:* Dunglass, cfr. (Evans); Yester Woods (Evans). *Edinburgh:* Auchendinny Woods (Grev.); Roslin (Ed. Herb.); Braids, cfr. (Evans); Craiglockhart Wood (Evans); nr. Swanston (Evans); Whitehill Glen, cfr. (Evans); Craigmillar Wood (Evans). *Linlithgow:* Carriber Glen, cfr. (Evans).

S.E. Highlands.—*Fife and Kinross:* St Andrews, cfr., 1854 (How.); Raith, cfr. (Young); Kinghorn (Evans); Orrock Hill, cfr. (Young); Aberdour, cfr. (Evans); Cambo (Young); Auchtertool (Young). *E. Stirling:* The Bannock Burn (Croall); Boquhan Burn, cfr. (K. & S.); Gargunnock (K. & S.); Blair Drummond (Scott); Causewayend (Evans). *S. Perth:* Strathyre, u. (Macv.); Trossachs (Ewing). *Mid*

Perth: Rumbling Bridge nr. Dunkeld (Barker); Killin district, c. (Macv.); Craig-an-Lochain, alt. 2000 ft. (Macv.); Clifton Burn, Tyndrum (Macv.). *N. Perth:* Persie (Barker); Glen Beg, Glen Shee (Ewing and Young); Glen Thaitneich (Ewing and Young); Dunkeld, cfr. (M'In.); Kinnoull Hill, cfr. (Meld.).

Mid E. Highlands.—*Forfar:* Reeky Linn, cfr., 1843 (Gard.); do., 1906 (Aimer); Guthrie, cfr., 1856 (Croall); nr. Montrose (Croall); Camlochan (Young); Gonar, cfr. (Ferg.); Inshewan (Ferg.). *Kincardine:* Den Fenella, cfr., 1856 (Croall); Blackhall, cfr., and Brae of Lathers, cfr. (Sim); Inchmarlo, cfr. (Fordyce). *S. Aberdeen:* Balmoral, cfr. (Michie); Braemar, Corriemulzie, and Abergeldie (Stabl.); Coire Ceanmor (Ewing). *N. Aberdeen:* Nr. Buchan (Ferg.).

N.E. Highlands.—*Banff:* Coast of Banff, cfr. (Barker); Tomintoul (Miss Macv.). *Elgin:* Nr. Grantown (Miss Macv.); Dreggie Burn (Miss Macv.). *E. Inverness:* Loch Vaa (Macv.); Farr Rocks, Kincraig (Miss Macv.).

W. Highlands.—*Kintyre:* Ronachan, cfr. (Macrae); Clachan, cfr. (Macrae). *Clyde Isles:* Loch Ranza, v.r. (Macv.). *Dumbarton:* Ardlui, u. (Macv.); Arrochar (Macv.). *W. Stirling:* Inversnaid (Macv.). *Argyll:* Puck's Glen (A. Murr.); Glen Nant, u. (Macv.); head of Loch Awe (Macv.); Ballachulish (Macv.); Kentallen, cfr. (Macv.). *W. Inverness:* Moidart, v.c., Ardnamurchan, v.c., Sunart, v.c. (Macv.); Morar (West); Glenfinnan and Fort William (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Islay, several places, as Bridgend, Port Ellen, Cairnmore, and Ardbeg (Gilm.); Kildalton Woods (Ewing). *Mid Inner Hebrides:* Tobermory, cfr., c. on rocks, f. on trees (Macv.). *N. Inner Hebrides:* Mill Burn, Broadford, f. on trees, also found on rocks (Macv.); Portree, cfr., on tree (Ewing).

Outer Hebrides.—Stornoway, on trees, cfr. (Gibs.); nr. Tarbert, on wood (West); Harris (Ewing).

Lower N. Highlands.—*W. Ross:* Strathcarron, f. (Macv.); Gairloch, cfr. (Miss Macv.). *E. Ross:* Nr. Fortrose (Miss Macv.).

Upper N. Highlands.—*E. Sutherland:* Nr. Loth, cfr. (Lillie). *W. Sutherland:* Strath Naver (Lillie). *Caithness:*

Several localities, as Forse, Langwell, and Dunbeath Strath (Lillie).

Orkney.—Kirkwall, on tree (West); Finstown (West).

PLEUROZIA Dum.

Pleurozia purpurea (*Lightf.*) *Lindb.*
J. cochleariformis Hook.

This conspicuous Atlantic species is generally distributed and frequently abundant on wet moors up to 1000 ft. alt. in the West Highlands, Hebrides, and North Highlands; continuing frequent, and locally in some quantity, in the western part of the East Highlands, but becoming very rare as it approaches the eastern side. It has only been found on one occasion in Forfar and twice in Aberdeen, and it is very rare in the Spey valley. It appears to be absent from North Perth, and is rare in Mid Perth, except near its western boundary. Although it is only plentiful from sea-level to about 1000 ft. alt. in the West Highlands, it is frequent to 1800 ft. alt. and ascends to 2400 ft. alt. This is the only Atlantic species which is common in the extreme north of the mainland, extending as a frequent plant in Caithness, and common in Hoy, Orkney, it being the only low-ground species of the group which does not prefer sheltered ground. It has not been found in Shetland, where it must be very local if present, as such a striking species would not be readily overlooked. This species is also found in the West Lowlands, but it is local and rare. It is frequent on a few hills in Kirkcudbright, descending to 400 ft. alt. (M'Andrew), and it has been found in a peat-moss at about 150 ft. alt. close to the Solway. Its absence from the north of England and from Wales, while at the same time it is widely distributed in Ireland and the west of Scotland, is one of the most interesting facts in the distribution of our hepatics.

Forms large reddish-purple tufts in peat-mosses and wet moors on the low ground, and among boulders and on rock ledges on the hills. The mountain plant is larger and lighter coloured than the low-ground plant. Inflorescence has not been noted in Scotland.

S.W. Lowlands.—*Kirkcudbright:* Auchencairn Moss, alt. *ca.* 150 ft. (Scott); Black Craig, New Galloway, *ca.* 400 ft. alt. (M'And.). *Wigtown:* New Luce Moor (M'And.).

S.E. Highlands.—*E. Stirling:* Flanders Moss, Bucklyvie (Croall); Glengyle, with *Herberta adunca* (K. & S.). *S. Perth:* Foot of Glenfalloch, Perthshire, 1849 (Ed. Herb.). *Mid Perth:* Ben Lawers, 1822 (Grev.); Glen Lochy, F. (Young); Ben Laoigh (Croall); do., F. (Macv.); Ben Dubh Craige, U. (Macv.); Ben Odhar, R.C. (Macv.); Ben More (Holmes); Am Binnean (Young); Coire Ardran, alt. 1900 ft. and below 1600 ft. (Macv.).

Mid E. Highlands.—*Forfar:* Clova Mountains, 1824 (Grev.). *S. Aberdeen:* Ben MacDhui, 1830 (Ed. Herb.); do., 1873 (Ferg.).

N.E. Highlands.—*E. Inverness:* Coire Glas, Glengarry, with *Herberta adunca* (How.); Carn Dearg, Aviemore, alt. 1600 ft. (Macv.).

W. Highlands.—*Kintyre:* Nr. Lochgilphead (Ewing). *Clyde Isles:* Nr. Loch Ranza (Campb.); do., peat-moss and Cairn na Cailleach, C. (Macv.). *Dumbarton:* Ben Vorlich (Gourlie *cf.* Pears. Hep. Brit., p. 92); do. (Macv.); moor between Garelochhead and Loch Long (Scott). *Argyll:* Glencoe, L.C. (Macv.); head of Loch Awe, R. on the low ground, F. on Ben Cruachan (Macv.); Ben Udlaidh, F. to 1800 ft. alt. (Macv.); King's House (Barker); Ben an Dothaidh (Ewing and Macv.); Ben Arthur, alt. 2400 ft., V.R. (Macv.); Coire Athoich (A. Murr.). *W. Inverness:* Ben Nevis, 1821 (Grev.); do. (Macv.); Glen Nevis (Macv.); Glenfinnan (Carr. *cf.* Pears. Hep. Brit., p. 92); Moidart, V.C. (Macv.); Ardnamurchan, V.C. (Macv.); Sunart, C. (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Jura (Ewing); Sgor Bhogachain, Islay, alt. 1000 ft. (Gilm.). *Mid Inner Hebrides:* Loch na Keal (Ewing); Loch Mishnish, C. (Macv.); Loch Frisa, C. (Macv.); Ben More (Kenn.). *N. Inner Hebrides:* Skye (Weiss *cf.* Pears. Hep. Brit., p. 92); nr. Loch Coruisk (Barker); peat-moss, Broadford (Macv.); Ben Cailleach, R.C. (Macv.); Sligachan (Miss Macv.).

Outer Hebrides.—Tarbert (West); Clisham (West); Balallan, many places (West).

Lower N. Highlands.—*W. Ross:* Ben Eay (How.); Strathcarron, V.C. (Macv.). *E. Ross:* Achnasheen (Macv.).

Upper N. Highlands.—*E. Sutherland:* Ben Griam Mohr (Lillie). *W. Sutherland:* Abundant about Cape Wrath (Hook. *cf.* Brit. Jung., p. 68); foot of Ben Clibreck, v.c. (Lillie). *Caithness:* Latheron (Lillie); Watten Moss (Lillie).

Orkney.—Hoy (West); Kirkwall (West); Ward Hill, Hoy (Lillie); Quoyawa, Hoy (Lillie); Trowie Glen, etc., v.c. (Lillie).

MADOTHECA Dum.

Porella Lindb.

Madotheca lævigata (*Schrad.*) *Dum.*

Widely distributed from Dumfries to Ross, but uncommon. It is rare in the West Lowlands, though frequent, according to M'Andrew, in subalpine glens about New Galloway. It has not been found in the Upper Clyde valley beyond the Lanark neighbourhood. In the East Lowlands it is very rare and has not been found in a typical state. It has been found in a few localities in Fife, but is rare in general in the eastern part of the East Highlands, though frequent in some of the more sheltered districts further inland. In the West Highlands it is more frequent than in the East Highlands, and is not uncommon in several districts, though in others it is rare or apparently absent. It is locally common in Mull, but has not yet been found elsewhere in the Hebrides. It is rare in West Ross, and has not been found north of this. It appears to be absent in the extreme north of the mainland as well as in Orkney and Shetland.

It is almost entirely a low-ground species, growing in moist, shady places about tree roots, stems, and lower branches of trees, and on rocks. It is nearly confined to glens when in the drier districts, as in the Lowlands and the east coast of the Highlands, but in the West Highlands it is also found frequently in natural woods at the foot of hills. It has been found in one locality among alpine species in Mid Perth at 1800 ft. alt. This species occurs on limestone and basalt as well as on schistose rocks. It forms large dark-green or yellow-green patches, frequently covering considerable spaces when on stems of trees. Sterile

female inflorescence is always abundant. The male plant has not been noted in Scotland.

S.W. Lowlands.—*Dumfries:* Crags nr. Dumfries, 1841 (Ed. Herb.); Penton Linns (Scott). *Kirkcudbright:* Garrock Wood (M'And.).

N.W. Lowlands.—*Ayr:* Largs (Ewing). *Lanark:* Cartland Crags (Macv.).

E. Lowlands.—*Edinburgh:* Bonally Burn (Evans).

S.E. Highlands.—*Fife and Kinross:* Ghoul's Den (How.); Kenly Den (How.); Kiels Den (A. Black); Raith (Young); Queich Glen (Evans). *S. Perth:* Menstrie Glen (K. & S.); Trossachs (Ewing). *Mid Perth:* Finlarig Wood, f. (Macv.); Craig-an-Lochain, alt. 1800 ft. (Macv.); Craig Vinean (M'In.); Braan, Inver (M'In.). *N. Perth:* Dunkeld (M'In.).

Mid E. Highlands.—*Forfar:* Castle Hill, Kinnordy (Lyell *cf.* Hook. Brit. Jung., p. 35); Den of Airlie, 1842 (Gard.); Reeky Linn (Aimer).

N.E. Highlands.—*E. Inverness:* Loch Ness (*cf.* Hook. Brit. Jung., p. 35).

W. Highlands.—*Kintyre:* Between Ardrishaig and Tarbert (Ewing). *Clyde Isles:* Goatfell (Campb.); Kyles of Bute (Ewing). *Dumbarton:* Arrochar Wood (Macv.). *W. Stirling:* Loch Lomond, 1822 (Grev.); Campsie Glen (Ewing). *Argyll:* Lismore (Macv.); Puck's Glen (A. Murr.). *W. Inverness:* Moidart (Macv.); Ardnamurchan (Macv.); Sunart (Macv.); head of Glen Nevis, on tree (Macv.).

Inner Hebrides.—*Mid Inner Hebrides:* Nr. Tobermory (Kenn.); do., c. on rocks (Macv.).

Lower N. Highlands.—*W. Ross:* Wood nr. Loch Maree (Carr.).

var. obscura *Nees*

E. Lowlands.—*Haddington:* Traprain Law (M'And.). *Edinburgh:* Bonally Burn (M'And.).

S.E. Highlands.—*Fife and Kinross:* Glen Queich (Evans).

var. Thuja *Nees*

E. Lowlands.—*Edinburgh:* Bonally Burn (M'And.).

S.E. Highlands.—*Fife and Kinross:* South of Muckhart (Evans).

Madotheca Thuja (*Dicks.*) *Dum.*

This rare species has only been found in a few localities on the coast, or near it, from Wigtown to the Outer Hebrides on the west side, and from Haddington to Kincardine on the east. It occurs on different formations, but the localities are too few to enable any preference to be noted. It is nearly always confined to exposed rocks on the sea-shore, where it forms large yellowish-brown or dark-green patches. The Loch Ness locality of Menzies, on which Dickson is supposed to have founded the species, is many miles inland, and unlike any recent locality known for the plant. I do not know if Menzies' plant has been recently examined, but from the locality I should expect it to be one of the more entire-leaved forms of *M. lævigata*. As with our other members of the genus, female inflorescence is common; the male plant has not been seen.

This is a Western and Mediterranean species in Europe, and is the only one of this group which has been found in more localities on our east than on our west coast. The great majority of our purely Atlantic species are absent from the east coast; the few which are present are very rare. If we consider this species as a Southern one which extends up the west coast of Europe, its preference for our drier and more sunny east coast agrees with the distribution of such a Southern species as *Lunaria cruciata*. The *Madotheca* also does not occur in moist, sheltered localities as do nearly all Atlantic species, but prefers exposed places in districts of small rainfall.

Scotia.—T. Drummond *sub. nom. Mad. platyphylloidea* (Herb. Carrington).

S.W. Lowlands. — *Wigtown:* Eggerness, Garliestown, 1889 (M'And.).

E. Lowlands. — *Haddington:* Nr. North Berwick (M'And.).

S.E. Highlands.—*Fife and Kinross:* Between Kirkcaldy and Kinghorn, on rocks by sea-shore (Young); nr. Lady's Tower, Elie (M'And.); Fife Ness, on rocks on sea-shore (Young).

Mid E. Highlands.—*Kincardine:* Urie Woods, Stonehaven (M'And.).

N.E. Highlands.—*E. Inverness:* On trees on the north side of Loch Ness, 1778 (Arch. Menzies *cf.* Hook. Brit. Jung., p. 40).

W. Highlands.—*Clyde Isles:* Blackwater Foot (Miss Macv.).

Inner Hebrides.—*Mid Inner Hebrides:* Tiree, 1897 (Macv.).

Outer Hebrides.—Barra, 1899 (Ewing).

Madotheca platyphylla (*L.*) *Dum.*

Widely distributed in the south, east, and centre of Scotland, but is uncommon. In the West Lowlands it is rare; in the East Lowlands it is rather less so, but has only been found in a few localities. In Fife and through the East Highlands it is frequent, and in a few places locally rather common. It is one of the rarest species in the West Highlands, and has not been found north of Loch Linnhe, nor in the Hebrides. It may be expected to occur in the eastern part of the North Highlands, but if so, it must be rare. This is a more Southern species than *M. rivularis*, and is confined to the low ground with us. It forms large spreading patches of a yellowish-green colour on rocks and walls in rather shady places, and about the roots of trees, but is less confined to shady ground than is *M. lævigata*. Fruit, which is mature in June, appears to be rare. This species has a preference for limestone districts, but is not confined to them.

S.W. Lowlands.—*Dumfries:* Wamphray Glen (Johns.); Drumlanrig (J. Murr.). *Kirkcudbright:* Grennan, New Galloway (M'And.).

N.W. Lowlands.—*Renfrew:* Glen, Misty Law (Scott).

E. Lowlands.—*Roxburgh:* Nr. Kelso (Scott). *Berwick:* Pease Dean (M'And.). *Edinburgh:* Craiglockhart Rocks (M'And.); Craigmillar Wood, on rocks (Evans).

S.E. Highlands.—*Fife and Kinross:* Lawhill, Largo (How.); Raith (Young); Duncarn Hill (Young); nr. Aberdour (Evans). *E. Stirling:* Rocks in the Bannock Burn (Croall). *S. Perth:* Menstrie Glen (Evans). *Mid Perth:* Nr. Killin, 1878 (R.K. in Croall Herb.); do., R.C. (Macv.); Moncrieff (Ferg.).

MID E. HIGHLANDS.—*Forfar:* Den of Airlie, 1843 (W. Jackson); Reeky Linn, 1845 (Gard.); The Burn, 1862 (Croall). *Kincardine:* Without locality, cfr. (Sim); Top of Cairn (Sim). *S. Aberdeen:* Balmoral (Stabl.).

N.E. HIGHLANDS.—*Elgin:* Banks of the Findhorn, 1848 (Croall).

W. HIGHLANDS. — *Kintyre:* Campbeltown (Ewing). *Argyll:* Lismore (Macv.).

MADOTHECA RIVULARIS *Nees*

A more common species than *M. platyphylla*, and widely distributed except in the west side of the Highlands. It is uncommon in the West Lowlands, though found in several places, mostly subalpine, but not in the Clyde valley above the Lanark neighbourhood. In the East Lowlands it is frequent and locally common, but has not yet been found in the higher parts of the Tweed valley. It is generally distributed throughout the East Highlands, except near its western boundary, and is common in some districts, but is rare in parts at least of the Spey valley. Throughout the West Highlands it is very rare, having only been found in a few localities in the Clyde area, but not north of it, nor in the Hebrides, nor the west side of the North Highlands. It appears to be rare throughout the last province, and has not been found in Orkney, and in only one locality in Shetland, this being as the var. *faroensis* Jens.

This species is most frequent on the low ground, being uncommon on the hills, but ascends to 3200 ft. alt. It forms dark-green, occasionally yellow-green patches on rocks, or sometimes about the roots of trees at the sides of streams, and on moist shady rocks on the hills. Fruit is rare, and has been noted as mature in October and November.

SCOTIA, without locality (T. Drummond).

S.W. LOWLANDS.—*Dumfries:* Moffat Water (Miss Macv.); Crawick Water, v.r. (Macv.). *Kirkcudbright:* Nr. Kenmure Castle (M'And.); Holme Glen (M'And.).

N.W. LOWLANDS.—*Ayr:* Largs (Ewing); Glen Afton (Macv.); Ladyland (Miss Macv.). *Renfrew:* Glen, Misty

Law (Scott). *Lanark:* Calderwood (J. Murr.); Corehouse (Young); Falls of Clyde (Ewing).

E. Lowlands.—*Peebles:* Cowie's Linn (Evans). *Selkirk:* Lindean, v.c. (Macv.). *Roxburgh:* Glen nr. Kelso (Scott); Fairy Dean, Melrose, v. (Macv.); Hawick, Wilton Dean (Macv.). *Berwick:* Newtondon (R. Renton); Pease Dean (Macv.). *Haddington:* Dunglass (M'And.); nr. North Berwick (M'And.); East Linton (Evans); Hailes (Evans). *Edinburgh:* Pentlands (A. Murr.); Hillend Hill (Evans); Craiglockhart Rocks (M'And.); Braid Hermitage (Evans); nr. Edgelaw Reservoir (Evans); Dalmahoy Woods (Evans). *Linlithgow:* Caribber Glen (Evans).

S.E. Highlands.—*Fife and Kinross:* Raith (Young); Glen Queich (Evans); Craig Rock, Largo (M'And.). *E. Stirling:* Bridge of Allan (Grev. Herb.); Wester Glen (K. & S.). *S. Perth:* Menstrie Glen (Croall); do. (Evans); Kilbride Castle nr. Doune (K. & S.); Wharry Glen (Evans). *Mid Perth:* Creag Chailleach (Young); Killin, c. on the low ground, r. on the hills, ascending to alt. 3200 ft. (Macv.); Falls of Ness nr. Muthill (Evans); Culdees Castle (Evans); Drummond Castle (Evans); nr. Perth (Meld.); Buchanty, cfr. exs. (Meld.). *N. Perth:* Glen Beg, Glen Shee (Ferg.); Balruddery (Scott); Persie (Barker); Craighall (Ferg.); Glen Beg, Glen Shee, per. (Ewing and Young).

Mid E. Highlands.—*Forfar:* Den of Airlie, 1837 (Bell ? in Ed. Herb.); do., 1839 (Gard.); Den of Mains, 1840 (Gard.); Den of Fullerton, 1841 (Croall); Reeky Linn, 1862 (Croall); do., 1906 (Aimer); Lorrenty (Ferg.); Noran (Ferg.); Fern (Ferg.); Camlochan (Ferg.). *Kincardine:* Den of Lathers (Sim). *S. Aberdeen:* Glen Callater, per. (Dickie); Cragendarroch (Ferg.). *N. Aberdeen:* Huntly (M'And.).

N.E. Highlands.—*Elgin:* Banks of the Findhorn, 1840 (Croall). *E. Inverness:* Farr Rocks, Kincraig (Miss Macv.).

W. Highlands.—*Kintyre:* Tarbert (Ewing). *Dumbarton:* Bowling Bay, 1840 (Grev. ? in Dickie Herb.). *Argyll:* Coire Athoich (A. Murr.).

Upper N. Highlands.—*Caithness:* R. Thurso, Dirlot (Lillie); Dorrery Hills (Lillie).

COLUROLEJEUNEA (Spruce) Schiffn.

Colurolejeunea calyptrifolia (*Hook.*) *Schiffn.*

One of the rarer species of the *Lejeuneæ* group, and almost confined to moist, sheltered ravines on the west coast of the Highlands. It also, though more rarely, occurs a few miles from the coast in ravines at the side of inland lochs which are only slightly above sea-level, as in the case of Loch Lomond. Like most of our *Lejeuneæ*, it is a small species, and liable to be overlooked by those unfamiliar with the appearance of this group in the field; but it is without doubt rare, and is often absent from ravines which seem favourable for its requirements. It has been found from Arran to Skye and West Ross, but only in small quantity. Though nearly always occurring on wet rocks in very sheltered ground, it has also been found on conifers, but not on deciduous trees. This species commonly grows unmixed in very small light-green patches directly on the rock, but is occasionally found on *Frullania Tamarisci* and *Radula aquilegia*, accompanied by other small *Lejeuneæ*. Perianths are usually present, but fruit, mature April to June, appears to be rare. It has been found on schistose, gneissic, and granite rocks.

W. Highlands.—*Clyde Isles:* Brodick, on fir-trees, 1847 (Lyon); Loch Ranza, on a rock, v.r. (Macv.). *W. Stirling:* Inversnaid, cfr., on rock with *D. hamatifolia* (Macv.). *Argyll:* Head of Loch Awe, on rock in ravine, v.r. (Macv.). *W. Inverness:* Moidart, widely distributed in small quantity on rocks, especially in ravines, very rarely on trees, also cfr. (Macv.); Ardnamurchan, Salen Burn (Macv.); Sunart, Resipol Burn (Macv.).

Inner Hebrides.—*N. Inner Hebrides:* Mill Burn, Broadford, on wet rock, on *Radula aquilegia*, with *Cololej. microscopica*, *Lej. patens*, *Harpalej. ovata* (Macv.).

Lower N. Highlands.—*W. Ross:* Strathcarron, on rocks in several ravines, r. (Macv.).

COLOLEJEUNEA (Spruce) Schiffn.

Cololejeunea minutissima (*Sm.*) *Schiffn.*

This is one of the rarest of the group in Scotland, and has only been found near the shore on the west coast, nearly always on tree stems. It forms small pale-green patches unmixed with other species, and can be generally recognised by the constant presence of perianths; fruit has not been found on our specimens, but gemmæ are common.

W. Highlands.—*W. Inverness:* Moidart, on old yew trees and on a rock at sea-shore, per., 1898 (Macv.).

Inner Hebrides.—*Mid Inner Hebrides:* Nr. Tobermory, on ash trees, per. (Macv.).

Cololejeunea microscopica (*Tayl.*) *Schiffn.*

The commonest of the small species of the group, being found in most of the low-lying, sheltered ravines of the western part of the Highlands which have been searched, also occurring on moist, sheltered rocks near the sea-shore; is very rare on the hills, but has been found up to 1700 ft. alt. Although confined to the west side of the country, it goes slightly over the watershed into the Eastern Highlands where the boundary is not distant from the west coast. In the West Lowlands this species is very rare and has only been found in one of the wetter districts. Its range at present known is from Kirkcudbright to West Ross. It will no doubt be found over all the west coast of the Highlands, though it does not appear to be present on the north coast, nor has it been found in Orkney. If it be really absent from Shetland, it can only be from the want of suitable localities, as it extends north to the Faroe Islands.

This species is almost entirely confined to rocks, but has been found on birch-trees. It is most common on schistose rocks, but occurs on gneissic formations and on granite, basalt, and limestone. It usually grows unmixed when directly on the rock, but when on *Metzgeria*, *Frullania*, etc., it is generally accompanied by other members of the group. Forms very pale green, thin patches or separate

stems. Perianths are rather rare; fruit is rare; gemmæ are unfrequent. It is interesting that this frequent member of the group in Scotland should be apparently absent from the Continent.

S.W. Lowlands.—*Kirkcudbright:* Glen Trool, with *Lej. patens* and *Harpalej. ovata,* on rock (Macv.).

S.E. Highlands.—*Mid Perth:* Achrioch Wood, Tyndrum, in several places on rocks, including limestone (Macv.).

W. Highlands.—*Clyde Isles:* Loch Ranza, F. on rocks, occurs also on trees (Macv.); Lamlash, on rock (M'And.). *Dumbarton:* Ravine, Ben Vorlich, on rocks (Macv.); Manse Burn and Wood, Arrochar, on rock (Macv.). *W. Stirling:* Inversnaid, F. on rocks (Macv.). *Argyll:* Glen Nant, on rocks (Macv.); head of Loch Awe, mostly on rocks, F. (Macv.); nr. Ballachulish, on granite rocks (Macv.); Kentallen, on rock (Macv.). *W. Inverness:* Moidart, on rocks, especially in ravines, R.C., and on a hill at 1700 ft. alt., 1898 (Macv.); Ardnamurchan, Salen Burn (Macv.); Sunart, Resipol Burn, C. (Macv.); Glenfinnan (Macv.); Camusnagail (D. A. Jones and H. H. Knight).

Inner Hebrides.—*Mid Inner Hebrides:* Nr. Tobermory, on rocks at side of stream (Kenn.); do., on rocks (Macv.); Allt na Searmoin (Kenn.). *N. Inner Hebrides:* Skye, 1893 (Prof. Weiss); Mill Burn, Broadford, on rock (Macv.).

Lower N. Highlands.—*W. Ross:* Strome Ferry, on mosses on rocks, C. (Macv.); Strathcarron, on rocks in ravine, R. (Macv.).

Cololejeunea calcarea (*Lib.*) *Schiffn.*

Widely distributed in the Highlands, but rare except in Mid and North Perth. It ranges from Stirling and Dumbarton to West Ross and Caithness. It has not been found in the Lowlands. In the East Highlands it is most frequent on the hills, ascending to 2700 ft. alt., though sometimes not rare in ravines and narrow glens near the foot of the hills. In the West Highlands it usually occurs in ravines, but has been found to 2000 ft. alt. on the hills. It seldom grows directly on the rock, being generally on tufts of mosses, where it frequently forms compact

yellowish-green patches, and it is found in exposed as well as sheltered situations. Although most frequent in districts in which lime is present, it is not confined to them, but is found also on schist and granite. Perianths are generally present; fruit, mature in June and July, is uncommon.

S.E. Highlands.—*Mid Perth:* Finlarig Burn (Macv.); Cam Creag, alt. 2700 ft. (Macv.); Craig-an-Lochain, alt. 1800 ft. (Macv.); Ben Heasgarnich (Ewing); Ben Laoigh, F. (Macv.); Achrioch Wood, side of stream, F. (Macv.); Clifton Burn, several places (Macv.); Ben Odhar, alt. 1400 ft. (Macv.). *N. Perth:* Den of Reichip nr. Dunkeld, *sub nom. Jung. hamatifolia* (Hook. *cf.* Brit. Jung., p. 51); Falar, several places (Barker); do. (Ferg.); Glen Tilt (J. Danford); Glen Beg, Glen Shee (Ew. and Young).

Mid E. Highlands.—*Forfar:* The Burn (Croall *cf.* Pears. Hep. Brit., p. 59); Clova, with *Loph. Muelleri* (Ferg.).

N.E. Highlands.—*E. Inverness:* Cawdor Wood (Croall *cf.* Pears. Hep. Brit., p. 59).

W. Highlands.—*Dumbarton:* Above Loch Long, on a rock (Scott); Manse Burn and Wood, Arrochar, cfr. (Macv.); ravine nr. Arrochar Station, F., cfr. (Macv.). *W. Stirling:* Campsie Glen, 1844 (Lyon). *Argyll:* Glen Nant (Macv.); Falls of Cruachan (Macv.); Ben Doureann, R. (Ewing and Macv.); Ben Arthur, alt. 2000 ft. (Macv.). *W. Inverness:* Moidart, R. (Macv.); Sunart, Resipol Burn, U. (Macv.).

Lower N. Highlands.—*W. Ross:* Strome Ferry (Macv.); Strathcarron, R. (Macv.).

Upper N. Highlands.—*Caithness:* Dorrery Hills (Lillie).

Cololejeunea Rossettiana (*Massal.*) *Schiffn.*

Is known only in one locality, a ravine close to the seashore. As there is carboniferous limestone in the neighbourhood, it is probable that the plant was found on this formation. This Southern species is rare over the whole of Britain.

E. Lowlands.—*Berwick:* Pease Dean, on a rock, per., 1901 (Macv.).

LEJEUNEA Lib.

Lejeunea cavifolia (*Ehrh.*) *Lindb.*
L. serpyllifolia Lib.

Widely distributed over the Lowlands, and generally distributed over the Highlands to Shetland. It is rare over considerable tracts of the Southern Uplands, where little rock is exposed, and in the Lowlands in general it is almost confined to shaded rocky glens. In the West Lowlands it is frequent in such glens, and is sometimes common, especially in subalpine districts. It is rare in the Upper Clyde valley. It is rather rare and local in the East Lowlands, though frequent in some glens. In Fife and the coast neighbourhood of the East Highlands it is frequent, and is common throughout almost the entire hilly districts of the Highlands and the Hebrides. It has been found in a few places in Orkney and Shetland, but appears to be uncommon on the former and rather rare on the latter. This species ranges from sea-level in the Lowlands to 3300 ft. alt. in Mid Perth. It is most common on the lower ground of the Highlands, but is also frequent on the hills, especially in Mid Perth. In the drier districts it is almost confined to rocks; in the West Highlands it is also frequent on trees. It is found on various formations, as schist, gneiss, granite, basalt, limestone, and sandstone, and is at times common on them all. It also grows on different kinds of trees. Forms light-green patches, generally almost white when dry, or occurs as scattered stems among mosses. Perianths are common, but fruit, mature from March to June, is rather uncommon, and is most frequent when on trees.

S.W. Lowlands.—*Dumfries:* Moffat (M'And.); Inglestone Hill, per. (Scott); Sanquhar district, L.C. (Macv.). *Kirkcudbright:* Dalskairth Wood, 1840 (Gray); New Galloway, many places (M'And.); Creetown (Macv.); Penkill Burn, C. (Macv.); Glen Trool, R.C. (Macv.). *Wigtown:* Nr. Portpatrick (M'And.); Loch Ryan, per. (Ewing); Knowe (Ewing); Glen Luce (Macv.).

N.W. Lowlands.—*Ayr:* Largs (J. Murr.); Darvel (Ewing); Alloway Brig (Ewing); Glen Afton, F. (Macv.).

Renfrew: Loch Thom (Ewing); Cloch (West); nr. Lochwinnoch, cfr. (Scott). *Lanark:* Dougalston Woods (Hopk. *cf.* Fl. Glott., p. 141); Cartland Crags, v.r. (Macv.); Tinto, alt. 1300 ft., r. (Macv.); Elvanfoot district, v.r. (Macv.).

E. Lowlands.—*Peebles:* Cowie's Linn (Evans); Talla Linns, c. (Macv.). *Selkirk:* Bowhill (Evans). *Roxburgh:* Rhymer's Glen, f. (Macv.) *Berwick:* Cockburnspath (M'And.); Pease Dean (Evans). *Edinburgh:* Loganlee (A. Murr.); Clubbiedean (M'And.); nr. Nether Habbie's Howe (Evans); nr. Lothianburn (Evans); Moorfoot Water (Evans).

S.E. Highlands.—*Fife and Kinross:* Raith (Young); Glen Queich (Evans); Auchtertool (Young). *E. Stirling:* Baston Burn (K. & S.). *S. Perth:* Allan Water, 1844 (Grev. Herb.); Alva Glen (Croall); Menstrie Glen (Croall); Strathyre, v.c. (Macv.); Castle Campbell Glen (Evans); Aberfoyle (Evans); Trossachs (Ewing and West); Tillicoultry Glen (Evans). *Mid Perth:* Meal Ptarmachan (C. J. Wild); Killin district, c. on the low ground, f. on the hills and ascending to 3300 ft. alt. (Macv.); Tyndrum district, c. (Macv.); Ben Chonzie (Meld.); Craig Vinean (M'In.); Cherry Bank nr. Perth (Meld.); Rumbling Bridge nr. Dunkeld (Holmes). *N. Perth:* Glen Tilt (Ferg.); Glen Shee (Ferg.); Glen Thaitneich (Ewing and Young); Dunkeld (M'In.); Pitlochry (Holmes).

Mid E. Highlands.—*Forfar:* Castle Hill, Kinnordy (Lyell *cf.* Hook. Brit. Jung., p. 42); foot of Glenesk, 1855 (Croall); Ravine of the Mourin (Croall); Den of Fullerton (Croall); Den of Glamis (Ferg.); Auchphersie (Ferg.); Noran (Ferg.); Glen Fee, alt. 2400 ft. (Ferg.); Sidlaws, cfr. (Fulton); Reeky Linn (Aimer). *Kincardine:* Brae of Lathers, Feugh Rocks, Paldy Hill with *Metzgeria pubescens*, and Crathes Rocks, per. (Sim). *S. Aberdeen:* Rocks by the waterfall on the Dee near Mar Lodge (J. Don *cf.* Hook. Brit. Jung., p. 42); Glen Callater, 1840 (Dickie); Fintry Wood, 1843 (Dickie); Craig Choinneach, 1848 (Ed. Herb.); Glen Cluny, Braemar, per., 1856 (Croall); Braemar (Croall); do. (Stabl.); Balmoral (Stabl.); Corriemulzie (Stabl.); Coire Ceanmor (West); Potarch (Sim).

N.E. Highlands.—*Elgin:* Dreggie Burn, etc. (Miss Macv.). *E. Inverness:* Carn Dearg, Aviemore (Macv.);

Glen Tromie (Miss Macv.); Kincraig (Miss Macv.); Fort Augustus (Macv.).

W. Highlands.—*Kintyre:* Campbeltown, per. (Ewing); Ronachan (Macrae); nr. Tarbert (Ewing). *Clyde Isles:* Kyles of Bute (Ewing); Bute, per. (Ewing); Loch Ranza (Campb.); do., c. (Macv.). *Dumbarton:* Ben Vorlich (Barker); do., to 2100 ft. alt., u. (Macv.); Ardlui, v.c. (Macv.); Arrochar, c. (Macv.); Tarbert, c. (Macv.); nr. Luss (Scott). *W. Stirling:* Inversnaid, c. (Macv.). *Argyll:* Benmore, etc. (A. Murr.); nr. head of Loch Long (Macv.); Glen Nant, c. (Macv.); Loch Awe district, c. (Macv.). *W. Inverness:* Moidart, v.c. (Macv.); Ardnamurchan, c. (Macv.); Sunart, c. (Macv.); Glenfinnan (Macv.); Glen Nevis (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Jura (Ewing); Ardimersay, Islay (Gilm.); Kildalton, etc., Islay (Ewing). *Mid Inner Hebrides:* Tobermory (Ewing); do., per. (Kenn.); do., v.c. (Macv.); Dervaig (Macv.); Allt na Searmoin (Kenn.); Glenforsa (Kenn.).

Outer Hebrides.—West coast of N. Uist (West); Tarbert (West).

Lower N. Highlands.—*W. Ross:* Ben Slioch (How.); Strathcarron, r.c. (Macv.); Strome Ferry, v.c. (Macv.); Kyle, u. (Macv.); Loch Maree (Miss Macv.). *E. Ross:* Nr. Achnasheen (Macv.); Loch Luichart (West).

Upper N. Highlands.—*E. Sutherland:* Ben Griam Mohr (Lillie); nr. Rogart (Lillie). *W. Sutherland:* Farr (Lillie); Forsinard (Lillie). *Caithness:* Several places, as Dorrery, Dunbeath Strath, Camster, and Burn of Ardoigal (Lillie).

Orkney.—Hoy (West); Stennis, per. (Lillie); Quoyawa, Hoy (Lillie).

Shetland.—Ronas Hill (Sim); Outskerries (Lillie).

var. planiuscula Lindb.

S.W. Lowlands.—*Dumfries:* Crawick Water (Macv.). *Kirkcudbright:* Black Craig, New Galloway (M'And.).

N.W. Lowlands.—*Ayr:* Ladyland, cfr. (Scott).

E. Lowlands.—*Peebles:* Cowie's Linn (Evans). *Selkirk:* Bowhill (Evans). *Berwick:* Pease Dean, cfr. (Macv.).

Haddington: Traprain Law (M'And.). *Linlithgow:* Carriber Glen (Evans).

Mid E. Highlands.—*Forfar:* Glen Fee (Sadler).

W. Highlands.—*W. Inverness:* Moidart (Macv.).

var. HETEROPHYLLA Carr.

S.W. Lowlands.—*Kirkcudbright:* Holm Glen, New Galloway (M'And.). *Wigtown:* Dunsky Glen, and Cairnryan, cfr. (Macv.).

N.W. Lowlands.—*Ayr:* West Kilbride, per., 1887 (Ewing).

Outer Hebrides.—Balallan, per. (West).

Upper N. Highlands.—*W. Sutherland:* E. of Scourie, per. (West).

Lejeunea patens *Lindb.*

Widely distributed over the west side of the country, and frequent near the west coast of the Highlands. It is uncommon in the West Lowlands, though frequent in a few localities. It has not been found in the East Lowlands or eastern part of the East Highlands in its typical form, but specimens have been seen from a few localities which seem to be rather better placed to *L. patens* than to *L. cavifolia*. Near the western boundary of the East Highlands the typical plant is found. Throughout the low-lying parts of the West Highlands it is frequent and sometimes rather common, as it is also in the more sheltered parts of the Hebrides. It is frequent in West Ross, and is probably frequent near the west coast of Sutherland, but it is rare in the extreme north of the mainland. Not yet found in Orkney, nor as the typical plant in Shetland.

This species occurs in the same formations as *L. cavifolia*, but is less seldom found growing directly on the rocks, or in unmixed patches. Most frequently it occurs creeping among *Metzgeria* and other species, and almost always in moist, well-sheltered ravines. It is frequent also on various trees in ravines. The typical plant is almost confined to the low ground: it is very rare on the hills, where it has been seen up to 2100 ft. alt. in the West Highlands. Perianths are common: fruit, mature in June, is uncommon.

Near Glasgow (Lyon).

S.W. Lowlands. — *Kirkcudbright:* New Galloway (M'And.); Glen Trool, cfr. (Macv.); Penkill Burn (Macv.). *Wigtown:* Clendry Glen (M'And.); Dunsky Glen (Macv.); Cairnryan (Macv.); Craigock Burn (Macv.).

N.W. Lowlands.—*Ayr:* Ness Glen, 1888 (M'And.). *Renfrew:* Loch Thom (Ewing).

E. Lowlands.—*Edinburgh:* Logan Burn Waterfall, *forma* (M'And.).

S.E. Highlands.—*Fife and Kinross:* Auchertool, *forma* (Young). *E. Stirling:* Gargunnock Craigs (K. & S.); Barton Burn, with *Metzgeria conjugata* (K. & S.). *S. Perth:* Strathyre (Macv.); Trossachs (Ewing). *Mid Perth:* Ben Laoigh (Ewing); Achrioch Wood, f. (Macv.); Finlarig Wood (Macv.). *N. Perth:* Glen Shee, 1879 (Ferg.); Reichip, Dunkeld (Barker).

W. Highlands.—*Kintyre:* Tarbert (Ewing); Clachan (Macrae); nr. Lochgilphead (Ewing). *Clyde Isles:* Corrie (Ewing); Loch Ranza, u. (Macv.). *Dumbarton:* Ardlui, in ravine, r.c. (Macv.); Ben Vorlich, alt. 2100 ft. (Macv.); Arrochar (Macv.); Garelochhead (Scott). *W. Stirling:* Inversnaid, f. (Macv.). *Argyll:* Glencoe (Macv.); Kentallen, u. (Macv.); Glen Nant (Macv.); head of Loch Awe, c. (Macv.); Glen Ure (Kenn.); Coire Athoich (A. Murr.); Kilmun (Scott). *W. Inverness:* Moidart, c., ascending to 1800 ft. alt. (Macv.); Ardnamurchan, f. (Macv.); Sunart, f. (Macv.); Glenfinnan (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Ardimersay, Islay, per. (Gilm.). *Mid Inner Hebrides:* Tiree (Macv.); nr. Tobermory, per. (Kenn.); do., f. (Macv.); Allt na Searmoin (Kenn.). *N. Inner Hebrides:* Skye (Weiss); Storr Rock (Ewing); Broadford district, r.c. (Macv.); Sligachan (Miss Macv.).

Outer Hebrides.—Barra (Ewing); Tarbert (West); Balallan (West).

Lower N. Highlands.—*W. Ross:* Strome Ferry (Macv.); Strathcarron, f. (Macv.).

Upper N. Highlands.—*W. Sutherland:* Strath Halladale, per. (Lillie). *Caithness:* Benaheilt (Lillie).

Shetland.—Northmaven, Burn of Vallor, etc., 1878 (Sim).

Lejeunea Macvicari *Pears.*

This species, which is at present endemic to Scotland, has only been found in two sheltered ravines near the shores of Loch Moidart. It generally occurs on old elm-trees, but is also found on moist rocks. Is frequently associated with *Lej. cavifolia, L. patens,* and *Harpalej. ovata.* The smooth perianths permit it to be readily distinguished in the field. When sterile it might be mistaken for *Lej. diversiloba* or *Harpalej. ovata.* Perianths are common in spring; fruit is frequent, and mature in April and May.

W. Highlands.—W. *Inverness:* Moidart, on old decaying elm in ravine, Allt a Mhuillin, Kinlochmoidart, cfr., 1898 (Macv.); do., on rock with *Radula aquilegia* (Macv.); Moidart, Allt Allan ravine, on old elm and on oak trees, cfr. (Macv.), in the last locality growing on *Metz. furcata, Plag. punctata, P. tridenticulata, Mad. lævigata,* and *Rad. complanata.*

MICROLEJEUNEA (Spruce) Jack et Steph.

Microlejeunea ulicina (*Tayl.*) *Evans*

This is the most widely distributed of our *Lejeuneæ* except *L. cavifolia* and *L. patens,* and extends inland from the west coast as far as the Trossachs. It is nowhere common, though frequent in many localities. Nearly always occurs on trees, chiefly birch, but is not confined to that tree, and is sometimes found on gorse, and rarely on conifers. Very rarely does it occur on rocks. It is less exclusively confined to moist, shady places than are any of the other species except *L. cavifolia,* though some degree of shelter is always present. It is nearly always found unmixed with the other species of the group, and occurs as a cluster of scattered stems which comparatively seldom form a layer. This species is very rare in the West Lowlands. Has not been found in the East Lowlands, nor in the East Highlands except near its western boundary. Is frequent in the West Highlands, but is rare in the exposed Hebrides. It has only been found in the lower part of West Ross in

the North Highlands, though it no doubt occurs further up the coast: it appears to be absent in the extreme north of the mainland. Female bracts are frequent, but fully developed perianths and male inflorescence have not been seen.

S.W. Lowlands.—*Kirkcudbright:* Kenmure Woods, on tree (M'And.). *Wigtown:* Castle Kennedy, on beech tree (Macv.).

N.W. Lowlands.—*Ayr:* Maich Glen, Ladyland (Miss Macv.).

S.E. Highlands.—*S. Perth:* Trossachs, on *Plag. punctata* on birch tree (Ewing and West). *Mid Perth:* Achrioch Wood, on several trees (Macv.).

W. Highlands.—*Kintyre:* Loch Caolisport (Ewing); Crinan (Ewing). *Clyde Isles:* Brodick, on fir-trees, 1847 (Lyon); Lamlash, on bark (M'And.); Loch Ranza, on beech tree (Campb.); do., c. on trees (Macv.); Bute, on tree (Ewing). *Dumbarton:* Manse Burn, Arrochar, on aspen tree, r. (Macv.). *Argyll:* Lochgoilhead, 1856 (Nichol); nr. Oban, on gorse bushes (Ewing); head of Loch Awe, on trees, f. (Macv.); Scuir Dearg, Ballachulish (West); Ballivecolan Burn, L. Creran (Kenn.). *W. Inverness:* Moidart, f. on trees, rarely on rocks (Macv.); Ardnamurchan, do. (Macv.); Sunart, do. (Macv.); Glenfinnan, on tree (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Ardimersay, Islay (Gilm.); Bridgend, Islay, on wood (Gilm.); Kildalton Woods, Islay (Ewing). *Mid Inner Hebrides:* Nr. Tobermory, on rock at side of stream, with *Lej. patens, Cololej. microscopica, Drepanolej. hamatifolia, Harpalej. orata* (Kenn.).

Outer Hebrides.—Tarbert, on rock (West).

Lower N. Highlands.—*W. Ross:* Strome Ferry, on trees, r.c. (Macv.).

DREPANOLEJEUNEA (Spruce) Schiffn.

Drepanolejeunea hamatifolia (*Hook.*) *Schiffn.*

Confined to the western side of the Highlands and to the Hebrides, being widely distributed though mostly rare. It is generally only present close to the coast, but, as with many other Atlantic species, it extends to the woods along

the side of low-lying inland lochs. In some parts of the coast of West Inverness it is rather common, though less so than *Harpalejeunea ovata*. This species is only found in well-sheltered places, and is therefore rare in the Hebrides. It appears to be absent in the extreme north, though it may probably be found on the west coast of Sutherland. The localities given in books for this species in the East Highlands should be transferred to *Cololejeunea calcarea*. It grows on rocks and trees—birch, hazel, oak, and ash—in ravines and moist woods, most commonly in schistose districts, but is also found on gneiss, granite, and basalt. It is frequently associated with *Harpalejeunea ovata*, and more rarely forms unmixed patches than that species does, especially when on trees. On rocks it is sometimes seen as closely applied scattered stems. Female bracts are frequent, but perianths very rare; male bracts are common, though well-developed antheridia are uncommon. Fruit has not been observed.

W. Highlands.—*Dumbarton:* Manse Burn, Arrochar, on rock (Macv.). *W. Stirling:* Inversnaid, on several rocks (Macv.). *Argyll:* Falls of Cruachan, on ash tree (Macv.); Kentallen, on trees and rocks (Macv.); Glen Ure and Balliveolan Burn, L. Creran (Kenn.). *W. Inverness:* Moidart, on rocks and trees, R.C. (Macv.); Ardnamurchan, Salen Burn (Macv.); Sunart, Resipol Burn, C. (Macv.).

Inner Hebrides.—*Mid Inner Hebrides:* Tobermory, on lichen on a tree, 1887 (Ewing); do., on rocks (Macv.). *N. Inner Hebrides:* Mill Burn, Broadford, on rocks, per. (Macv.).

Outer Hebrides.—Tarbert, on rocks (West).

Lower N. Highlands.—*W. Ross:* Strathcarron, Udlar ravine, V.R. (Macv.).

HARPALEJEUNEA (Spruce) Schiffn.

Harpalejeunea ovata (*Hook.*) *Schiffn.*

One of the commoner Atlantic species of the group, being widely distributed and frequent on the west side of the Highlands. It is very rare in the West Lowlands, being

known at present only from one locality, but it may be expected to be found in others. Throughout the coast region of the West Highlands it has been found in most of the ravines which have been searched for these small species, and it is common in many of them, as well as in shady woods which line the sheltered parts of the coast and low-lying inland lochs. It has been found in several places in the Inner Hebrides, but is rare in the exposed Outer islands. Is frequent in West Ross, and doubtless occurs on the west coast of Sutherland, though absent in the extreme north of the mainland.

Grows most commonly on rocks, sometimes directly on them, as light-green patches; but it is generally found creeping among *Frullania Tamarisci* or *F. germana* and *Metzgeria*, and often with *Lej. cavifolia* and *L. patens* and the smaller species of the group. It is most commonly met with in schistose districts, but is also frequent on gneiss, granite, basalt, and occurs on limestone. It is frequent on trees—birch, hazel, oak—but less so than on rocks. Female bracts are frequent; perianths have not been seen.

S.W. Lowlands.—*Kirkcudbright:* Glen Trool, on rock (Macv.).

W. Highlands.—*Clyde Isles:* Loch Ranza, u. (Macv.). *Dumbarton:* Allt Dubh Uisgue, on rock, r. (Macv.). *W. Stirling:* Inversnaid, f. on rocks (Macv.). *Argyll:* Glen Nant, on rocks (Macv.); head of Loch Awe, c. on rocks and trees (Macv.); Kentallen, on rock (Macv.); Glen Ure and Balliveolan Burn (Kenn.). *W. Inverness:* Moidart, on rocks and trees, c. (Macv.); Ardnamurchan, Salen Burn, c. on trees (Macv.); Sunart, Resipol Burn, c. on rocks and trees (Macv.); Glenfinnan (Macv.).

Inner Hebrides.—*Mid Inner Hebrides:* Nr. Tobermory, on rocks (Kenn.); do. (Macv.); Allt na Searmoin (Kenn.). *N. Inner Hebrides:* Mill Burn, Broadford, r.c. on rocks (Macv.); Ben Cailleach, rocks and sides of stream, alt. *ca.* 300 ft. (Macv.).

Outer Hebrides.—Barra, on *Frull. Tamarisci*, on rock (Ewing); Tarbert, on rocks (West).

Lower N. Highlands.—*W. Ross:* Nr. Loch Maree, 1889 (Carr.); Strome Ferry, on rocks and trees, f. (Macv.).

MARCHESINIA S. F. Gray.

Phragmicoma Dum.

Marchesinia mackaii (*Hook.*) *Gray*

A rare species only known from a few localities along the west coast from Wigtown to West Inverness and Skye, and nearly always close to the sea-shore. It is a southern plant, probably more frequent in England than with us, and occurring there also in inland localities. Has only been found on rocks in Scotland, and preferably limestone, though occurring also on schist and basalt. It forms thin patches on rather dry and frequently exposed rocks, and is nearly black or olive-green in colour, but is occasionally reddish-brown or reddish-yellow. Perianths and male bracts are common; neither fully developed fruit nor antheridia have been noted in Scotland.

S.W. Lowlands.—*Wigtown:* Mull of Galloway, 1844 (Grev. Herb.); nr. Glenluce, 1846 (Ed. Herb.); Knock Bay (M'And.); nr. Portpatrick, per. (Macv.).

W. Highlands.—*Clyde Isles:* Lamlash, on rocks on sea-shore (M'And.). *W. Inverness:* Moidart, on schistose rocks in a few places, and in quantity on rocks bordering a sand-dune, per. (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Ard, Port Ellen, Islay, on damp rock, per. (Gilm.). *Mid Inner Hebrides:* Tobermory, rock on sea-shore, per. (Kenn.); do., in two ravines, per. (Macv.). *N. Inner Hebrides:* Nr. Broadford, on limestone rock, on sea-shore, per. (Macv.).

JUBULA Dum.

Jubula hutchinsiæ (*Hook.*) *Dum.*

This rare species has only been found in a few localities on the west coast, near the shore, on schistose and sandstone rocks, usually in caves but also in ravines. It is more frequent in Arran than elsewhere. Forms extensive dark-green patches on very wet rocks and in caves. Although a fairly large plant, is difficult to detect when in thin layers, but usually some stems are found hanging from

corners of rock, and their glistening appearance attracts attention. Sterile inflorescence, both male and female, is common, but mature antheridia and fruit have not been seen.

W. Highlands. — *Kintyre:* Loch Caolisport (Ewing). *Clyde Isles:* Sandstone fissure between Brodick and Corrie, 1847 (Lyon); Loch Ranza, in several caves (Macv.); Lamlash (M'And.). *Argyll:* Bullwood, Dunoon, 1846 (Gour.); cave at Dunoon (Lyon). *W. Inverness:* Sunart, Resipol Burn, on wet rocks in ravine (Macv. and W. H. Pearson).

Inner Hebrides.—*S. Inner Hebrides:* Carrick Ford, Islay, on wet stones in shady place (Gilm.).

FRULLANIA Raddi

Frullania Tamarisci (*L.*) *Dum.*

Generally distributed over the whole of the country except in the flat agricultural districts of the Lowlands and East Highlands. It is rather uncommon in general throughout the West Lowlands, though frequent in many subalpine districts, and sometimes common; it is uncommon in the Upper Clyde valley above the Lanark neighbourhood. It is uncommon as a whole in the East Lowlands, more so than in the West Lowlands, and is rare in some districts, especially in the drier parts near the coast. In the Tweed valley it is uncommon, though locally frequent, but in some glens it is common. It increases in quantity north of the Forth in the low-lying parts of Fife and the East Highlands, but is not generally common until the hilly districts are reached. Over all the subalpine and lower part of the alpine regions of the Highlands it is common, being one of the most frequent species, while in the wetter districts of the West Highlands it is very abundant, being found on almost every tree and rock in the coppices near the foot of hills along the more sheltered lochs near the coast. It is very common in the sheltered parts of the Inner and Outer Hebrides, and common throughout the North Highlands, Hoy in Orkney, and in Shetland. Although preferring some shelter, it also is common in exposed places on the west coast, but not when in the drier parts of the

country. It is frequent on the hills, and ascends to 3200 ft. in Mid Perth and to at least 2500 ft. alt. in the West Highlands. It is found on all formations. It is equally common on trees and rocks in the moist and sheltered parts of the Highlands, but in the drier and exposed districts it is mostly confined to rocks. This species is commonly sterile, but perianths are frequent, and fruit is not rare when on trees, being usually mature in August and September, but extending from June to October.

The var. *cornubica* is confined to rocks near the shore of the Atlantic coast. The var. *robusta*, at least when well marked, is also confined to the west side of the country, and usually to rocks near the shore.

S.W. Lowlands.—*Dumfries:* Hartfell Mountain, 1830 (Grev. Herb.); Loch Skene (Grev. Herb.); Craigs nr. Dumfries, 1840 (Cruicks.); Langholm (Scott); Whitecoombe (Johns.); Drumlanrig (J. Murr.); Sanquhar district, U. (Macv.); Crichope Linn, R.C. (Macv.). *Kirkcudbright:* Dalskairth, 1840 (Gray); New Galloway (M'And.); Carsphairn (West); Glen Trool (Macv.); Penkill Burn (Macv.). *Wigtown:* Galloway, 1843 (Grev. Herb.); Portpatrick (M'And.); Knowe (Ewing); nr. Penninghame, C. (Macv.); Glen Luce (Ewing).

N.W. Lowlands.—*Ayr:* Largs (J. Murr.); W. of Loch Doon (West); Glen Afton, L.C. (Macv.). *Renfrew:* Loch Thom (Ewing); Cloch (West); Inverkip (Lee); Glen, Misty Law (Scott). *Lanark:* Lowther (Lyon); Falls of Clyde (Ewing); Wabston (J. Murr.); Elvanfoot, U. (Macv.); Green Lowther, alt. 1800 ft., R. (Macv.).

E. Lowlands. — *Peebles:* Cowie's Linn (Evans); Broughton district, U. (Macv.); Crook Burn, R.C., and Talla Linns, C. (Macv.). *Selkirk:* Golf Course, Selkirk (Evans); Bowhill (Evans); Glenkinnon Burn, C. (Macv.). *Roxburgh:* Nr. Teviothead (Miss Macv.); Melrose district, F. (Macv.). *Berwick:* Threeburnfoot (Renton); Cockburnspath, R. (M'And.); Pease Dean (Evans). *Haddington:* Dunglass (M'And.); Park Burn, Newlands (Evans); nr. Tantallon Castle (M'And.); Gullane Links (M'And.); Traprain Law (M'And.); Garleton Hill (Evans). *Edinburgh:* Rocks at the foot of Edinburgh Castle (Lightf. *cf.* Fl. Scot, p. 783);

Edinburgh Park (Mr Yalden *cf.* Lightf. Fl. Scot., p. 1148). Pentland Hills (Grev.); do. (A. Murr.); Hillend Wood (Evans); nr. Glencorse Reservoir (Evans); Torduff (Evans); Craiglockhart (A. Murr.); Nether Habbie's Howe (Evans). *Linlithgow:* Dalmeny Wood (M'And.).

S.E. HIGHLANDS.—*Fife and Kinross:* Dysart Woods, 1847 (W. W. Evans); St Andrews, 1854 (How.); Newburgh (How.); Kinghorn (M'And.); Dunearn Hill (Young); Raith (Young); Aberdour (Evans); Fife Ness (Young); Glen Queich (Evans); Isle of May (Evans). *E. Stirling:* Gargunnock Hill and Wester Glen (K. & S.); Boquhan Burn (K. & S.); Glengyle (K. & S.). *S. Perth:* Strathyre, c. (Macv.); Menstrie Glen (Evans); Aberfoyle (Evans); Trossachs (Ewing). *Mid Perth:* Killin (Wild); do., c. to 3200 ft. alt. (Macv.); Ben Laoigh (Dixon, etc.); do., v.c. (Macv.); Tyndrum district, c. (Macv.); Achrioch Wood, c. (Macv.); Coire Ardran, f. (Macv.); Rumbling Bridge nr. Dunkeld (Holmes). *N. Perth:* Meal Uain and Glen Beg, Glen Shee (Ferg.); Glen Sochaidh (West); Glen Tilt (West); Ben Vrackie (Holmes); Ben Gulabin (Ewing and Young); Dunkeld (M'In.).

MID E. HIGHLANDS.—*Forfar:* Den of Airlie, 1839 (Gard.); Baldovan Woods, 1842 (Gard.); Reeky Linn, 1843 (Gard.); do., 1906 (Aimer); nr. Auchterhouse, 1846 (Gard.); Glen Prosen (Ferg.); Camlochan (Ewing and Young); Lundie (Aimer). *Kincardine:* Michals, 1836 (Dickie); several places, as Den of Lathers, Blackhall, Dalfro, Fordoun, and Den of Garol, etc. (Sim). *S. Aberdeen:* Pannanich Cliffs, 1842 (Dickie); Braemar, 1856 (Croall); Craigendall (Ferg.); Potarch (Sim); Balmoral, and Lion's Face, Braemar (Stabl.). *N. Aberdeen:* Turriff Bridge (Ferg.).

N.E. HIGHLANDS.—*Elgin:* Nr. Grantown, several places (Miss Macv.). *E. Inverness:* Cawdor, Nairn, 1857 (Croall); nr. Aviemore, many places (Macv.); Kincraig (Miss Macv.); Glen Tromie, per. (Miss Macv.); Fort Augustus, f. (Macv.).

W. HIGHLANDS. — *Kintyre:* Carradale, per. (Ewing); Tarbert (Ewing); Clachan (Macrae); nr. Lochgilphead (Ewing). *Clyde Isles:* Goatfell (Campb.); Loch Ranza (Campb.); do., cfr., c. (Macv.); Kyles of Bute (Ewing). *Dumbarton:* Helensburgh (Ewing); Arrochar, c. (Macv.); Ardlui, r.c. (Macv.); Ben Vorlich, alt. 2000 ft. (Macv.);

Tarbert (Macv.). *W. Stirling:* Inch Cailleach (K. & S.); Inversnaid, c. (Macv.). *Argyll:* Puck's Glen, Ben More, etc. (A. Murr.); Glencoe (Macv.); nr. head of Loch Long (Macv.); Lismore (Macv.); Glen Nant, c. (Macv.); Loch Awe district, do., also cfr. (Macv.); Inveraray (Camph.); Ballachulish (Macv.); Loch Tulla (Macv.); Ben Dourcann (Macv.); Ben Arthur, u. to alt. 2500 ft. (Macv.). *W. Inverness:* Ben Screel (Ewing); Moidart, Ardnamurchan, Sunart, v.c. (Macv.); Morar (West); Glenfinnan, c. (Macv.); Ben Nevis, c. (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Islay, several places, as Ardimersay, Ardbeg, Carrick Ford, etc. (Gilm.); Machrie (Miss Evans). *Mid Inner Hebrides:* Ben More (Ewing); Tobermory (Kenn.); Dervaig (Macv.); Glenforsa (Kenn.); Tiree (Macv.); Coll (Macv.). *N. Inner Hebrides:* Broadford district, c. (Macv.); Sligachan (Miss Macv.); Portree (Ewing).

Outer Hebrides.—Barra (Ewing); Benbecula (Ewing); Tarbert (West); Balallan, many places (West); Carloway (Gibs.); N. Uist (West); Barvas (West); St Kilda (J. Waterston).

Lower N. Highlands.—*W. Ross:* Strome Ferry (Barker); do., c. (Macv.); Kyle, v.c. (Macv.); Strathcarron, c. (Macv.); Gairloch, etc. (Miss Macv.). *E. Ross:* Achnasheen, c. (Macv.); Loch Luichart (West); Fortrose (Miss Macv.).

Upper N. Highlands.—*E. Sutherland:* Strath Ullie, and The Ord nr. Helmsdale (Lillie); nr. Rogart (Lillie). *W. Sutherland:* Strath Halladale (Lillie); Farr (Lillie); nr. Ben Rosail (Lillie); Ben Laoghal (Lillie); Tongue (Lillie). *Caithness:* Many places, as Reisgill Burn, Latheronwheel, Maiden Pap, etc. (Lillie).

Orkney.—Hoy (West); Stromness (West); nr. Kirkwall (West).

Shetland.—Nr. Lerwick (West); Vallor (Sim); Yell (Sim); Clousta (Grieve); Scalloway (West); Bressay (West); Unst (Sim); Uyea (Beeby); Loch of Girlsta (Beeby).

var. cornubica *Carr.*

S.W. Lowlands.—*Wigtown:* Nr. Dunsky Glen (Macv.).
N.W. Lowlands.—*Renfrew:* Lochwinnoch (Ewing).

W. Highlands.—*Argyll:* Glencoe (Macv.); Kentallen (Macv.).

Inner Hebrides.—*Mid Inner Hebrides:* Coll (Macv.).

Outer Hebrides.—Tarbert (West).

Upper N. Highlands.—*W. Sutherland:* Farr (Lillie).

Orkney.—Segal Burn, Hoy (Lillie).

Shetland.—Northmaven (Sim); Muckle Heog Cairns, Unst (Lillie).

var. robusta *Lindb.*

W. Highlands.—*Clyde Isles:* Loch Ranza (Macv.). *W. Inverness:* Moidart (Macv.).

Inner Hebrides.—*N. Inner Hebrides:* Mill Burn, Broadford, per. (Macv.).

Lower N. Highlands.—*W. Ross:* Gairloch (Miss Macv.).

Frullania microphylla (*Gottsche*) *Pears.*

This rare species has only been found in a very few localities on the west coast, on steep rocks near sea-level, and in one locality near the shore of an inland loch. It forms extended, thin, reddish-brown patches very closely attached to the rock. Perianths and male inflorescence are usually present in mixture; mature fruit has not been observed.

S.W. Lowlands.—*Wigtown:* Nr. Larbrax, Galloway, on rocks by the seaside, per., August 1843 (Grev. Herb. *sub. nom. Jung. fragilifolia*, Taylor *m.s.s.*); Craigcock Burn, rock, per. (Macv.).

W. Highlands.—*W. Stirling:* Inversnaid, on a few boulders (Macv.). *W. Inverness:* Moidart, on nearly perpendicular shady rocks close to the sea-shore, per. (Macv.).

Inner Hebrides.—*Mid Inner Hebrides:* Tobermory, on a rock (Macv.).

Frullania fragilifolia *Tayl.*

Widely distributed from Dumfries to Shetland, but usually uncommon or rare except in the West Highlands. It is rare in the West Lowlands, and very rare in the East Lowlands, Fife, and the neighbourhood of the coast of the East Highlands. In the wetter, more inland districts of the

last province it is frequent in several places. Throughout the West Highlands it is frequent and sometimes rather common, but is less frequent in the Hebrides. It appears to be rare in the extreme north, at least in the unsheltered districts, and in Shetland. It is a low-ground species and is uncommon on the hills; it ascends to 2700 ft. alt. in Mid Perth and to 2000 ft. alt. in the West Highlands. In the Lowlands and the drier part of the country in general it usually grows on rocks, while in the West Highlands it is more frequent on trees of various kinds, including conifers. It prefers shelter with moisture, but is sometimes seen in exposed situations. It occurs on schistose, gneissic, and granite rocks, but has not been found on limestone. This species never forms loose, thick patches such as *F. Tamarisci* commonly does, the stems being closely attached to the rock or tree. Perianths are rather common, and fruit, mature from April to July, is frequent in the West Highlands, but rare elsewhere.

S.W. Lowlands.—*Kirkcudbright:* Penkill Burn, on rock (Macv.). *Wigtown:* Portpatrick (M'And.); Craigock Burn, rocks (Macv.).

E. Lowlands.—*Edinburgh:* Rosslyn Woods, on oak tree (Evans).

S.E. Highlands.—*Fife and Kinross:* St Andrews Cliffs (W. Smith). *S. Perth:* Trossachs (Carr. *cf.* Pears. Hep. Brit., p. 30). *Mid Perth:* Killin district, f. on the low ground, r. on the hills, as Cam Creag, alt. 2600 ft., Ben Lawers, alt. 2700 ft. (Macv.); Finlarig, cfr. (Young); Achrioch Wood, on a tree and rocks (Macv.); Coire Ardran, alt. 1900 ft. (Macv.). *N. Perth:* Glen Beg, Glen Shee (Ferg.); Dunkeld, ♂ (M'In.); Falar (Barker).

Mid E. Highlands.—*Forfar:* Glen Fee, Clova (Ferg.). *Kincardine:* Several places, as Mount Shade, 1875, Fordoun, Blackhall Rocks, Feugh Rocks, and Brae of Lathers (Sim). *S. Aberdeen:* Glen Muick (Sim); Balmoral, on decaying birch tree (Michie); Corriemulzie (Stabl.); Glen Beg, Braemar (Stabl.).

N.E. Highlands.—*Elgin:* Dreggie Burn, on tree (Miss Macv.). *E. Inverness:* Carn Dearg, Aviemore, alt. 1200 ft. (Macv.).

W. Highlands. — *Kintyre:* Campbeltown (Ewing); Carradale (Ewing). *Clyde Isles:* Loch Ranza, R., per. and ♂, on rocks (Macv.). *Dumbarton:* Ardlui, R.C. (Macv.); Ben Vorlich, alt. 2000 ft. (Macv.); Arrochar (Macv.); Tarbert (Macv.). *W. Stirling:* Inversnaid, on tree (Macv.). *Argyll:* Head of Loch Awe, F., also cfr. (Macv.); nr. Ballachulish (Macv.); Kentallen, on tree, per. (Macv.); Ben Arthur, alt. 1000 ft. (Macv.). *W. Inverness:* Moidart, C. and cfr. F. (Macv.); Ardnamurchan, do. (Macv.); Sunart, do. (Macv.); Glenfinnan (Macv.); head of Glen Nevis, per. (Macv.); Ben Nevis (Macv.); Coire Dheirg, C. on trees (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Kildalton Woods, Islay (Ewing). *Mid Inner Hebrides:* Tobermory, on *Marchesinia Mackaii* (Kenn.); do. on sycamore, and rock (Macv.).

Outer Hebrides.—Barra (Ewing); nr. Tarbert (West); Benbecula (Ewing).

Lower N. Highlands.—*W. Ross:* Strome Ferry, F. (Macv.); Strathcarron, F. (Macv.); Kyle (Macv.).

Upper N. Highlands.—*E. Sutherland:* Nr. The Mound (Lillie). *Caithness:* Ben Rha, Reay (Lillie).

Shetland.—Busta (Sim); Unst (Sim).

Frullania germana *Tayl.*

This Atlantic species is almost confined to the west side of the Highlands, where it is frequent, and in several places common. It has not been found on the mainland of the east side of the country, its only locality on that side being on the Isle of May. It is very rare in the West Lowlands, and has not been found there for many years, but it will probably be found in some localities when it is less confused with *F. Tamarisci.* It is distributed over almost the whole of the low ground of the West Highlands in the neighbourhood of the coast, and extending along the wooded sides of low-lying inland lochs, but is generally rare when at any distance from the coast. In Moidart, West Inverness, it is quite a common species, and it is locally common in the Hebrides. It has not been found in the extreme north of the mainland, but occurs in several places in Shetland.

In the West Highlands it is more common on trees than on rocks, but it is also frequent on shady rocks, especially when close to the sea-shore, and often just above tide-mark. In the Hebrides, where trees are scarce, it appears to prefer rocks even when sheltered trees are present. It grows on schist, gneiss, basalt, and also limestone. When on trees it prefers birch, but is frequent on oak, hazel, and sometimes conifers, mountain ash, and willows. Grows in large, frequently loose patches of a generally lighter colour than *F. Tamarisci*, but never occurs in ascending tufts among old heather and mosses as the latter does. Perianths are common, much more so than in *F. Tamarisci*, and are usually present when the plant is on trees; fruit is frequent, except when on rocks, and is commonly mature from August to October, but it has been noticed also in May.

S.W. Lowlands.—*Wigtown:* Seaside banks, Galloway, 1843 (Grev. Herb. *sub. nom. Jung. Tamarisci*).

S.E. Highlands.—*Fife and Kinross:* Isle of May, 1879 (Evans).

W. Highlands.—*Kintyre:* Carradale (Ewing); Tarbert (Ewing). *Clyde Isles:* Loch Ranza, per. (Campb.). *Dumbarton:* Allt Dubh Uisgue, on trees (Macv.). *Argyll:* Coire Athoich, per. (A. Murr.); Puck's Glen (A. Murr.); head of Loch Awe, R. (Macv.); Kentallen, per. (Macv.); Glen Ure, and Balliveolan, L. Creran (Kenn.). *W. Inverness:* Moidart, C. (Macv.); Ardnamurchan, F. (Macv.). Sunart, F. (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Jura (Ewing); Ardimersay, Islay, per. (Gilm.); Ard, Port Ellen (Gilm.); Carrick Ford, on stones (Gilm.); Kildalton Woods (Ewing). *Mid Inner Hebrides:* Tobermory (Ewing); do., C. on rocks, per. (Macv.); Glenforsa, shore (Kenn.); Tiree (Macv.). *N. Inner Hebrides:* Broadford district, F. (Macv.).

Outer Hebrides.—Barra (Ewing); Tarbert, cfr. (West); Harris, per. (Ewing).

Lower N. Highlands.—*W. Ross:* Strome Ferry, per. and ♂, F. (Macv.); Strathcarron, per., F. (Macv.).

Shetland.—Nr. Lerwick (Sim); Busta (Sim); Neeans (Beeby); Aith, on *Sticta pulmonaria* (Beeby); Unst (Sim); Muckle Heog Cairns, Unst (Lillie).

Frullania dilatata (*L.*) *Dum.*

One of the most generally distributed species of the low ground, but rare or absent in exposed districts. In the Lowlands it is almost confined to trees, being frequent in deciduous woods in the cultivated regions, and often common in the more sheltered coppices of the low-lying glens. In the valleys above 1000 ft. alt. it is very rare, and is scarce in such localities even with the presence of a fair amount of timber. It is common over most of the East Highlands below 1000 ft. alt., especially in the more sheltered parts, but is uncommon in some districts bordering the Moray Firth and in the valley of the Spey. Is very common in the West Highlands, occurring equally on trees and rocks when in woods. Its frequency in the Inner Hebrides is in proportion to the small number of trees there, and in the Outer Hebrides it is very rare, and has only been found in the planted wood at Stornoway. It is frequent in the North Highlands where there is sheltered wood, but is in general rare owing to the absence of this condition. It has been found in Orkney and in two localities in Shetland. It is rarely found above 1000 ft. alt., but has been found at 1400 ft. alt. in North Perth, and on one occasion at 2000 ft. alt. in Mid Perth. It prefers rather drier habitats than *F. Tamarisci*, and for this reason is frequently seen on smooth-barked trees, while the latter prefers those with rough bark. All our species of *Frullania*, except *F. microphylla*, occur also on conifers, though not very commonly. Perianths are usually present, and fruit is common, especially from December to April. The female plant commonly occurs in mixture with the male plant, which is not the case with *F. Tamarisci*.

S.W. Lowlands. — *Dumfries:* Brownhall nr. Dumfries, 1840 (Cruicks.); Moffat (Johns.); Sanquhar district, f. (Macv.); Crichope Linn, f. (Macv.). *Kirkcudbright:* New Galloway (M'And.); Glen Island (Ham.); Carsphairn (West); Penkill Burn, c. (Macv.); Glen Trool, c. (Macv.); Creetown (Macv.). *Wigtown:* Lochnaw (J.S.Stirling); Portpatrick (M'And.); Knowe (Ewing); Glen Luce, cfr. (Macv.); Castle Kennedy, cfr. (Macv.); nr. New Luce (Ewing).

N.W. Lowlands. — *Ayr:* Mochra Hill (Ewing); nr.

Dalmellington (West); Glen Afton, F. (Macv.). *Renfrew:* Cloch (West); Inverkip (West). *Lanark:* Falls of Clyde (Ewing); Cartland Crags, U. (Macv); Craigairtan (Campb.); St John's Kirk, Symington (Macv.); Elvanfoot, in sheltered places, U. (Macv.).

E. Lowlands. — *Peebles:* Macbiehill (Evans); Cowie's Linn (A. Murr.); Lamancha (Evans); Broughton district, F. (Macv.); Tweedsmuir, U. (Macv.). *Selkirk:* Howden (Evans); Lindean, C. (Macv.); Glenkinnon Burn, C. (Macv.); Caddonfoot, C. (Macv.). *Roxburgh:* Nr. Melrose (R. Renton); do., R.C. in deans (Macv.). *Berwick:* Pease Dean, U. (Macv.); Longformacus, cfr. (Miss Macv.). *Haddington:* Dunglass, cfr. (Evans); Yester Wood (Evans); Lennoxlove (Evans). *Edinburgh:* Edinburgh Park (Mr Yalden *cf.* Lightf. Flor. Scot., p. 1148); nr. Edinburgh, 1829 (Grev.); Braid Woods, 1845 (W. W. Evans); Hopetoun Woods, 1847 (W. W. Evans); nr. Inveresk (Evans); nr. Edgelaw Reservoir (Evans); Penicuik (Evans); Gorebridge (Evans); Roslin Glen (A. Murr.). *Linlithgow:* Dalmeny Woods (M'And.); Caribber Glen (M'And.).

S.E. Highlands. — *Fife and Kinross:* Fife, without nearer locality, 1839 (W. W. Evans); Kinghorn (M'And.); Kirkcaldy (Young); Raith (Young); Aberdour (Evans); Dysart (Young); Camto (Young). *E. Stirling:* Gargunnock (K. & S.). *S. Perth:* Nr. Doune (K. & S.); Aberfoyle (Ewing); Culdees Castle (Evans); Trossachs, cfr. (Ewing); Strathyre, U. (Macv.); Muirton Glen (Evans); Wharry Glen, cfr. (Evans). *Mid Perth:* Killin district, C. on the low ground (Macv.); Craig-an-Lochain, alt. 2000 ft. (Macv.); nr. Tyndrum (Ewing). *N. Perth:* Glen Beg, Glen Shee, alt. 1400 ft. (Ferg.); Dunkeld (M'In.); Kinnoull Hill, cfr. (Meld.); Stenton (Barker).

Mid E. Highlands.—*Forfar:* Baldovan Woods, 1842 (Gard. ? in Ed. Herb.); Reeky Linn, 1843 (Gard.); do., 1906 (Aimer); Den of Airlie (Gard.); Pitpointie, 1846 (Ed. Herb.); Guthrie, cfr., 1856 (Croall); Inshewan (Ferg.); Glen Prosen (Ferg.); Fullerton Den (Ferg.). *Kincardine:* Brae of Lathers, cfr. (Sim); Blackness, cfr. (Sim); Inchmarlo, cfr. (J. W. Fordyce); Stonehaven Wood (M'And.). *S. Aberdeen:* Dry Den (Dickie). *N. Aberdeen:* Mormond Hill (Ewing); Turriff (Lillie).

N.E. Highlands.—*E. Inverness:* Boat of Garten, "v.r." (Miss Macv.); Kincraig (Miss Macv.); Fort Augustus, c. (Macv.).

W. Highlands.—*Kintyre:* Carradale (Ewing); Campbeltown (Ewing); Ronachan, cfr. (Macrae). *Clyde Isles:* Bute (Grev.); Loch Ranza, c. (Macv.). *Dumbarton:* Ardlui, r.c. (Macv.); Arrochar, f. (Macv.); Tarbert, c. (Macv.). *W. Stirling:* Drymen (K. & S.); Inversnaid (Macv.). *Argyll:* N. of Crinan Canal (West); Kilmun (Wilkie); Puck's Glen, cfr. (A. Murr.); nr. head of Loch Long (Macv.); Lismore (Macv.); Glen Nant, c. (Macv.); Loch Awe district, c. and c. cfr. (Macv.); Inveraray (Campb.); Ballachulish (Macv.); Kentallen (Macv.). *W. Inverness:* Glen Nevis (West); Fort William (Macv.); Glenfinnan (Macv.); Moidart, v.c. (Macv.); Ardnamurchan, do. (Macv.); Sunart, do. (Macv.); Morar (West); nr. Glenelg (Ewing).

Inner Hebrides.—*S. Inner Hebrides:* Islay, several places, as Ardimersay, Bridgend, cfr., Cairnmore Wood, Carrick Ford (Gilm.); Kildalton Woods, cfr. (Ewing) *Mid Inner Hebrides:* Glenmore (Ewing); nr. Tobermory (Kenn.); c. about Tobermory (Macv.); Tiree (Macv.); Dervaig (Macv.). *N. Inner Hebrides:* Broadford district, c. (Macv.); Portree (Ewing).

Outer Hebrides.—Stornoway (West).

Lower N. Highlands.—*W. Ross:* Strome Ferry (Macv.); Strathcarron, r.c., cfr. c. (Macv.); L. Maree, cfr., and Gairloch (Miss Macv.). *E. Ross:* Nr. Fortrose (Miss Macv.).

Upper N. Highlands.—*E. Sutherland:* Nr. The Mound (Lillie). *W. Sutherland:* Strath Naver (Lillie); Tongue (Lillie), *Caithness:* Watten, Strath of Bilbster, Langwell, cfr., Latheronwheel (Lillie).

Orkney.—Finstown (West).

Shetland.—Nr. Lerwick (Sim); Unst (Sim).

ANTHOCEROS L.

Anthoceros lævis *L.*

Widely distributed from Wigtown to Caithness, but uncommon. It is more frequent in the Lowlands than elsewhere, but has only been found sparingly in any district.

This species and *A. punctatus* will doubtless be found to be more generally distributed than the records show, but it is not to be expected that they will be otherwise than uncommon with us, especially the present plant, which is of a more Southern type than the other. It appears to be rare in the Highlands, and has been seldom found in any of our hilly districts. It forms dark-green flat patches at the side of ditches and on moist fallow ground. Fruit, which is mature from September to December, is uncommon.

S.W. Lowlands.—*Wigtown:* Loch Ryan, cfr. (Ewing).

N.W. Lowlands.—*Ayr:* Mauchline, cfr., 1890 (Ewing). *Renfrew:* Nr. Lochwinnoch village, in ditch, cfr. (Scott).

E. Lowlands.—*Roxburgh:* Bowden, roadside (Macv.). *Edinburgh:* Newpark (Evans). *Linlithgow:* Nr. Bathgate, at side of ditch, with *Blasia pusilla* (Evans); South Queensferry, on waste ground (Evans).

W. Highlands. — *Kintyre:* Clachan (Macrae). *W. Inverness:* Moidart, R. (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Nr. Lathraoig Distillery, cfr. (Ewing).

Upper N. Highlands.—*Caithness:* Nr. Lybster, side of potato field, cfr., 1900 (Lillie).

Anthoceros punctatus *L.*

This species appears to be more frequent in the low-lying districts of the Highlands than in the Lowlands, but its distribution is not well known. It seems, however, to be very rare in the southern counties. It has only been found in small quantity in the various localities where it has been noted. It forms nearly flat dark-green patches at the side of ditches and on moist fallow ground. Fruit is common, and is mature from July to November.

S.W. Lowlands. — *Wigtown:* Nr. Portpatrick, cfr. (M'And.).

E. Lowlands.—*Roxburgh:* Field nr. Kelso, with *Riccia sorocarpa* and *Fossombronia* (Scott).

S.E. Highlands.—*N. Perth:* Nr. Dunkeld, cfr. (M'In.).

Mid E. Highlands.—*S. Aberdeen:* On moist bank north of Powder Magazine, Aberdeen (Dickie).

W. Highlands.—*Kintyre:* Mull of Kintyre *v.* Aug. 1847 (Lyon). *Dumbarton:* Tarbert, cfr. (M'And.). *W. Inverness:* Moidart, R. (Macv.).

Inner Hebrides.—*S. Inner Hebrides:* Killegan, nr. Mull of Oa, Islay, in stubble field, cfr. (Gilm.).

Lower N. Highlands.—*W. Ross:* Gairloch, cfr. (Miss Macv.).

Upper N. Highlands.—*Caithness:* Nr. Lybster, cfr. (Lillie).

APPENDIX

P. 53. *Riccia bifurca.*—Barker's record is the earlier, and should be given the first place.

P. 60. *Lunularia cruciata.*—*Peebles:* Darnhall, Eddleston (M'And. *in litt.*).

P. 64. *Marchantia polymorpha.*—*Selkirk:* Henderland Burn (Macv.).

P. 69. *Aneura multifida.*—*Kintyre:* Loch Caolisport (Ewing).

P. 71. *Aneura latifrons.*—*Elgin:* Nr. Ben More (Miss E. Armitage).

P. 72. *Aneura palmata.*—*Kintyre:* Loch Caolisport (Ewing).

P. 99. *Gymnomitrium alpinum.*—*Banff:* Ben MacDhui, alt. 3800 ft. (Wheldon and Wilson).

P. 106. *Marsupella emarginata.*—*Selkirk:* Nr. Gordon Arms, Yarrow, on roadside bank (Macv.).

P. 122. *Haplozia crenulata.*—*Clyde Isles:* Lamlash (M'And.).

P. 124. *Haplozia sphærocarpa.*—*Ayr:* West Kilbride, per. (Ewing).

P. 132. *Jamesoniella Carringtoni.*—*W. Inverness:* Moidart, on shady bank near sea-shore, with *Herberta adunca*, alt. 300 ft. (Macv.).

P. 136. *Lophozia inflata.*—*E. Inverness:* Coire Sneachda, Cairngorm, alt. 3600 ft., per. (Wheldon and Wilson).

P. 145. *Lophozia ventricosa.*—*Banff:* Cairngorm, alt. 3900 ft. (Wheldon and Wilson).

P. 157. *Lophozia barbata.*—*Haddington:* Gullane Links (M'And.).

P. 161. *Lophozia Floerkii.*—*Wigtown:* Killywhan (Ewing). *Banff:* Cairngorm, alt. 3600 ft. (Wheldon and Wilson).

P. 173. *Sphenolobus exsectæformis.*—*Clyde Isles:* Nr. Brodick (Miss Macv.).

P. 187. *Leptoscyphus anomalus.—Elgin:* Nr. Ben More (Miss E. Armitage). *Kintyre:* Loch Caolisport (Ewing).

P. 199. *Harpanthus Flotowianus.—Mid Perth:* Cam Creag, head of Glen Lochy (Ewing).

P. 206. *Cephalozia connivens.—Kintyre:* Loch Caolisport (Ewing).

P. 207. *Cephalozia lunulæfolia.—Wigtown:* Killywhan (Ewing).

P. 216. *Hygrobiella laxifolia.—Clyde Isles:* Lamlash (M'And.).

P. 221. *Cephaloziella myriantha.—Renfrew:* Castle Semple Loch, per. (Ewing).

P. 225. *Odontoschisma Sphagni.—Kintyre:* Loch Caolisport (Ewing).

P. 235. *Bazzania tricrenata.—Kintyre:* Loch Caolisport (Ewing).

P. 243. *Lepidozia trichoclados.—Orkney:* The Kame, Hoy, per. (Lillie).

P. 244. *Lepidozia setacea.—Selkirk:* Mount Benger peat-moss and Eldinhope Burn, Yarrow (Macv.).

P. 246. *Blepharostoma trichophyllum.—Selkirk:* Mount Benger and Eldinhope Burns (Macv.).

P. 256. *Ptilidium ciliare.—Roxburgh:* Eildon Hill, alt. *ca.* 900 ft., v.r. (Macv.). *Elgin:* Nr. Ben More (Miss E. Armitage). *Banff:* Ben MacDhui, alt. 3900 ft. (Wheldon).

P. 269. *Scapania gracilis.—Selkirk:* Henderland Burn (Macv.). *Elgin:* Nr. Ben More (Miss E. Armitage).

P. 273. *Scapania nemorosa.—Kintyre:* Loch Caolisport, cfr. (Ewing).

P. 277. *Scapania purpurascens.—Banff:* Cairngorm, alt. 3500 ft. (Wheldon and Wilson).

P. 283. *Scapania paludosa.—Mid Perth:* Ben Laoigh (Ewing).

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ERRATA

p. 2 et seq., *for* Leptocyphus *read* Leptoscyphus
p. 89, for *Hub.* read *Hüb.*
p. 167, for *Cranz* read *Crantz*
p. 210, *for* (Tayl.) Dum. p.p. *read* (Tayl. p.p.) Dum.
pp. 234, 251, for *Trevis* read *Trevis.*
p. 236, for *Nees* read (*Nees*)

PRINTED BY NEILL AND CO., LTD., EDINBURGH.

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